

CASSELL'S
ENCYCLOPÆDIA
OF GENERAL INFORMATION

WITH COLOURED PLATES AND MAPS
AND NUMEROUS FULL-PAGE ENGRAVINGS

DEODORANT—FRIAR

SPECIAL EDITION

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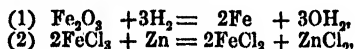
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CASSELL'S ENCYCLOPÆDIA

Deodorant, a substance used to absorb noxious vapours and thus to combat foul odours—*e.g.* animal charcoal and iodoform.

Deoxidation, any process in which the whole or part of the oxygen is extracted from a body—*e.g.* the conversion of oxides to metals in smelting. This was the sole original signification of the term, but it was afterwards extended to processes in which any negative element or radical is extracted or replaced by a more positive one. Thus both the changes represented by the following equation would be called deoxidation:—



though in the second no oxygen is present in either of the reacting substances. The term *reduction*, which is practically synonymous, is, however, more frequently employed, in both the original and extended sense, than the older word deoxidation.

Department of Control, a department created in 1870 to perform the civil administrative duties of the army. It was abolished in 1875. [COMMISSARIAT, TRANSPORT.]

Dephlegmator, an apparatus used in alcohol distilleries for freeing the spirit from water.

Dephlogisticated Air. [OXYGEN, PHLOGISTON.]

Depilatories, chemical substances employed for removing hairs from the skin.

Deposit, a general term applied in geology to all aqueous rocks, with reference sometimes to their composition, sometimes to their sources or modes of origin, or even to their age. It is applied to the chemical precipitates thrown down from solution, such as stalagmite or rock-salt, and to accumulated remains of plants or animals, such as a bed of lignite or of oyster-shells, as well as to the sediment, whether clay or sand, thrown down from mechanical suspension in water. It might even be applied to the layers of various ores and veinstones lining the two sides or "cheeks" of a vein or "lode," though we know little as to the mode of their deposition. Deposits may be laid down in the sea, in lakes, or in river-beds; as rain-wash at the foot of slopes; or even as loess (*q.v.*) spread out by wind over wide land areas. A deposit may be a mere film, as in the

mud left on the water-meadows by a river-flood; or continuous, steady, and uniform conditions may produce marine deposits many feet in unbroken thickness. The term is not applicable to intrusive igneous rocks or to eruptive lavas; but even volcanic dust and ashes may, if they fall into water or are spread out at all uniformly over a large surface, be termed deposits.

Deposition is any affidavit, or solemn affirmation in lieu thereof; but the term is more commonly applied to a statement written down by an officer of the court, such as an examiner in the High Court, embodying the substance of the answers obtained from the deponent in the course of his examination. It is competent for either party to a suit to examine his own unwilling witness in this way, but only upon notice to the other side, who then and there may cross-examine the deponent, the side who has called him in that case re-examining him. Depositions are also taken before justices of the peace for the purpose of a criminal prosecution; and in case the deponent should die before the trial, or be too ill to attend, these depositions may be used in evidence, subject to certain legislative restrictions. This term is also used in ecclesiastical law, being the censure by which a clergyman is removed from the ministry—*i.e.* deprived of holy orders.

De Profundis (*out of the depths*), the first words of the Latin version of Psalm cxxx., part of the Roman Catholic funeral service.

Deptford, a parliamentary borough, now forming part of London, returning two members to the London County Council and one member to Parliament. It is in the counties of Kent and Surrey, which are separated by a creek, into which the Ravensbourne flows into the Thames upon the south bank. Its chief points of present interest are that it is the site of the foreign cattle market for London, and also of the central station of the Electric Light Company, who, from their magnificent installations at Deptford, profess to be able to supply London with electric light when the demand for it shall become general. An arsenal was founded here by Henry VIII., and there was an extensive Government dockyard, which only ceased to exist in 1869. There are many points of historical interest connected with Deptford. The old Elizabethan naval heroes were familiar figures in its streets. Here Kit Marlowe was killed; here Peter the Great

served his apprenticeship in the ship-building art; and it was at the neighbouring Saye's Court that John Evelyn had reason to bewail the depredation that the Czar committed upon the well-trimmed hedges by employing a man to wheel him through them on a barrow. Of the two ancient parishes of St. Nicholas and St. Paul, the former is in Kent and the latter in Kent and Surrey. There is still a royal victualling yard in Deptford, besides a good deal of industry in pottery and the manufacture of chemicals. Pop. (1901), 117,844.

De Quincey, THOMAS (1785-1859), a noted English man of letters, was the son of a Manchester merchant who called himself Quincey, the son afterwards assuming, or resuming, the prefix "De," and was born at Greenhay. The death of his father in 1793 gave him part-claim to a fortune of £30,000. He was educated at Manchester grammar school and at Bath, whence he ran away; and his wanderings in Wales, his experience of the tidal bore in the valley of the Wye, his hardships in London, where he made the acquaintance of "Poor Ann," whom he has immortalised, form a not uninteresting part of his autobiography in the *Confessions of an Opium-Eater*. In 1803 he went to Oxford, and it was here that the pangs of gastralgia, or stomachic neuralgia, drove him to the use of opium, to which he became an habitual slave. It seems, however, to have been justifiable for medical reasons in his case. From Oxford—through the influence of Coleridge, whom he met at Bristol—he went to Grassmere, and associated with Wordsworth and Southey. From 1803 to 1828 he spent his time chiefly here or in London, and was a prolific writer, magazine articles being his special forte. He wrote for, among others, *The London Magazine*, *Knight's Quarterly*, and *Blackwood's*. From 1828 to 1840 he lived in Edinburgh, and then at Lasswade, near Edinburgh. He was married, and had many children; but he was no man of business, and his eccentricities were marked. To vast general knowledge, and a quaintly precise though involved style, he united great originality in choice and treatment of subjects. His *Confessions*, *Murder as a Fine Art*, *The Casuistry of Roman Meals*, are good specimens of his manner. He made contributions of some value to political economy.

Deraajat, a district of the Punjab, lying in the valley of the Indus, constituting a commissioner-ship, and containing Dera Ghazi Khan, Dera Ismael Khan, and Bannu. It is a fertile, well-watered tract of 17,681 square miles, and contains many towns and villages. Most of its population are Mohammedans.

Derbend, a fortified Russian town, on the western shore of the Caspian, and capital of the Russian Government of Daghestan. The chief industries are the manufacture of woollen stuffs, copper and iron ware, and rose-water, and there is a considerable trade in saffron, which is grown in the neighbourhood. The town, which was Persian, is said to have been founded by Alexander the Great and fortified by Chosroes. The Arabs took it in the

seventh century, and the Caliph Harun Al-Raschid is said to have lived there. Among the many ancient ruins of the neighbourhood is an ancient wall said to have been built as a protection against barbarian incursions. The town became Russian in 1722, and again finally in 1795.

Derby (Saxon name *Northworthige*), a municipal and parliamentary borough and capital of the county of Derby, upon the Derwent, which is crossed by a bridge of three arches. The town is very ancient, being almost the site of the old Roman settlement of *Derventia* or *Derventio*, which was at Little Chester on the other side of the river. The modern town, situated in a wide fertile valley open to the south, is well and regularly built, and has some fine public buildings, among them the county hall, a school of art and infirmary, and a free library and museum. The three principal churches are All Saints, St. Alkmund, and St. Werburgh, at the last of which Dr. Johnson was married. Derby is a county borough and sends two members to Parliament. The chief industries are silk, cotton, paper, and porcelain manufactures and the preparation of articles in Derbyshire spar. The manufacture of porcelain owed its origin to Mr. Duesbury in 1750, and crown Derby china is well known. John Lombe established the first silk factory in 1714. There is a large carriage factory here, and the Midland Railway has extensive works employing a large number of hands. The town is well served by railways. Richardson the novelist was born here. Pop. (1901), 105,785.

Derby, EDWARD GEOFFREY SMITH STANLEY, FOURTEENTH EARL OF, was born at Knowsley Park, Lancashire, in 1799. He was educated at Eton and at Christ Church, Oxford, and in 1819 gained the Chancellor's prize for his Latin poem on *Syracuse*. In 1820 he was returned to Parliament for Stockbridge in the Whig interest, but he did not deliver his maiden speech until 1824. He then quickly made his mark, however, and was regarded as a distinct accession to the Liberal ranks. In 1826 he changed his seat from Stockbridge to Preston, where his family wielded great influence. In the following year, in conjunction with other prominent Whigs, Mr. Stanley effected a coalition with Canning, and became Under-Secretary for the Colonies. The coalition was dissolved on the death of Canning. On the formation of Lord Grey's Ministry in 1830 Mr. Stanley was appointed Chief Secretary for Ireland. Going before his constituents for re-election, he was defeated by "Orator" Hunt, but a seat was found for him at Windsor. In 1832 he became member for North Lancashire, which constituency he continued to represent until his elevation to the peerage. In consequence of the Repeal agitation in Ireland and the alarming and fatal riots throughout the country, the Chief Secretary was called upon to introduce a stringent Coercion Bill, which he successfully carried through the House of Commons against the fierce opposition of O'Connell and his friends. Mr. Stanley's tenure of the Chief Secretaryship was marked by the passage of many valuable Irish measures. In 1833 he became Secretary for the

Colonies. Mr. Stanley seceded from the Whigs in 1834, when it was proposed to appropriate the surplus revenues of the Irish Church to educational purposes. He was appointed Colonial Secretary in the Conservative Administration of 1841, and held that appointment for four years. In 1844 he was called to the Upper House in his father's barony of Stanley of Bickerstaffe, having for ten years preceding borne the courtesy title of Lord Stanley. When Sir Robert Peel proposed the repeal of the Corn Laws, he retired from the Cabinet, and in 1846 took the lead of the Protectionists. Succeeding to the earldom in 1851 on the death of his father, in February, 1852, he became the head of a Conservative Government, but the Ministry was defeated in the ensuing December, and resigned office. Lord Derby again became Premier in February, 1858, but, being defeated on the question of Parliamentary Reform, he appended to the country. When the new House of Commons met in June, 1859, a vote of want of confidence was carried, and the Government resigned. In 1866 Lord Derby became Prime Minister for the third and last time. In conjunction with Mr. Disraeli he passed the Reform Act of 1867, which he himself described as "a leap in the dark." He resigned the Premiership in 1868, and his last speech in Parliament was made, in 1869, in opposition to the Irish Church Disestablishment Bill. He died at Knowsley in 1869. Lord Derby was one of the first of parliamentary speakers, and was styled "the Rupert of debate," in consequence of the fiery nature of his eloquence and his powers of invective. He was also an excellent scholar, and published a blank-verse translation of Homer's *Iliad*.

Derby, EDWARD HENRY SMITH STANLEY, EARL OF, born 1826, was the fifteenth earl, being the son of the well-known Conservative Prime Minister and statesman. He was educated at Rugby and at Trinity College, Cambridge, where he graduated in honours. In 1848 he entered the House of Commons as member for King's Lynn, and in 1852 he was appointed Under-Secretary in the Foreign Office. In 1858-59 he was Secretary for India in his father's Government at the epoch of the transfer of the East India Company's jurisdiction to the Crown. In 1866-68 he was Foreign Secretary in the Derby-Disraeli Government, and in 1869 succeeded to the earldom upon the death of his father. In 1874 he was again Foreign Secretary in the Conservative Government, but resigned in 1878 over the question of calling out the reserves and occupying Cyprus. In 1880 he joined the Liberal ranks, and was Colonial Secretary 1882-85. In 1886 he departed from Mr. Gladstone upon the question of Irish Home Rule. He was Lord Rector of Glasgow and Edinburgh Universities. He died in 1893.

Derby Day, the last Wednesday in May or (occasionally) the first in June, on which the "Derby Stakes" for three-year-olds are run for at the summer meeting on Epsom Downs. They were instituted in 1780, and are called after the then Earl of Derby. The journey there and back from London by road, the subject of many caricatures,

has been shorn of much of its former glory (and disorder) by increased railway facilities. The course is $1\frac{1}{2}$ miles. The quickest time hitherto has been 2 min. 36 $\frac{1}{2}$ sec. (1906). Colts now carry 9st.; fillies 8st. 9lbs.

Derbyshire, a central county of England, 55 miles in length, with a breadth varying from 15 to 30 miles, containing 658,624 acres, or 1,029 square miles, and divided for political purposes into seven divisions, returning each one member to Parliament. Its name, Deorby, or Deoraby, shows that it was once forest-land occupied by wild animals. The county falls geologically into three divisions, that of the north-west, which is bleak and irregular, and forms part of the Pennine range, which, having here the general name of "The Peak," and reaching a height of 2,000 feet, is the watershed of central England; that of the east and north-east, which belongs to the English coal-fields; and that of the south, which is in the Trent Valley, and has a rich red soil proceeding from the sandstone. The principal rivers, which cut their picturesque passage through the limestone, are the Derwent, Dove, Erewash, Rother, and the Trent. About five-sixths of the county is arable or pasture-land, producing good crops of oats and turnips, and containing fine dairy farms. George Eliot has given us a good picture of Derbyshire farms and farmers in *Adam Bede*. Among the minerals are coal, iron ore, lead, gypsum, zinc, and fluor spar. Besides its agriculture, the county is noted for silk, cotton, and lace manufactures, for the making of machinery and agricultural implements, and for its breweries. There are many remains of antiquity, such as tumuli, and a stone circle. Formerly part of the kingdom of Mercia, and ruled by, among others, the Lady of Mercia, Ethelfreda, daughter of Alfred the Great, Derby became a Danish centre. Later in history Derby was the farthest point south reached by Charles Edward in his expedition into England. Brindley the engineer, Chantrey the sculptor, and Arkwright were all Derbyshire men. Among its towns Chesterfield is notable for its manufacturing importance, and its curious church-spire is well-known to most travellers to the north, and the waters of Buxton and Matlock are widely famed. Haddon Hall and Chatsworth are also of great interest. Pop. (1901), 490,886.

Derelict, anything cast away or abandoned, with the intention of quitting the ownership thereof. Goods thrown out of a vessel to lighten same in time of distress are not derelict for the want of intention. The term is also applied to land left dry by the sea shrinking back below the usual high-water mark, or by a river changing its bed.

Dermestids, a family of beetles of which the eggs are usually deposited in animal matter; the larvæ, when hatched, burrow through this and soon secure its putrefaction. Thus the larvæ of a single brood of the Bacon Beetle (*Dermestes lardarius*, Linn.) will destroy a whole ham.

Dermosclerites, the spicules found in the hard dermal layer of Alcyonaria.

Dervish (from a Persian word = *doormat*, i.e. beggars at the door), a class of Mohammedan

begging monks, who are bound to poverty, chastity, and obedience. Some are in monasteries, others scattered among the people. They somewhat resemble the fakirs of India. At their public services, the highest order, the dancers, whirl round and round, shouting incessantly, "There is no God but God," while the "howlers," a less exalted class, sway themselves backwards and forwards, shouting the same sentence. These services are one of the sights of Cairo. The term was also applied to the fanatical Soudanese troops of the Mahdi, or to those of them who had been a pilgrimage to Mecca.

Derwent, the name of four English rivers:—

(1) That of Derbyshire, rising in the Peak, and flowing between 60 and 80 miles into the Trent; (2) in Yorkshire, (3) in Durham, and (4) in Cumberland, draining Lakes Bassenthwaite and Derwentwater, and falling into the Irish Sea at Workington. There is also a Derwent in Tasmania with a course of over 100 miles, and navigable by a large estuary to Hobart.

Derwentwater, a lake of Cumberland, called also Keswick Lake, in the vale of Keswick, having a length of three miles from Skiddaw in the north to the hills of Borrowdale in the south, and an average breadth of $1\frac{1}{2}$ miles. There are many islands, and fish are abundant, especially perch. In the N.E. is the cascade of Lodore, commemorated by Southey.

Derwentwater, JAMES RADCLIFFE, EARL OF, an amiable but unfortunate Jacobite partisan, who was born in London in 1689, being an illegitimate grandson of Charles II. He took a rash part in the premature rising of 1715, and, starting early in October of that year, he was forced to surrender within five weeks. In spite of great efforts made to obtain his pardon, he was executed on Tower Hill in February, 1716, and his estates were confiscated. They formed, in 1736, the endowment of the Greenwich Naval Hospital.

Dessaix de Veygoux, LOUIS CHARLES ANTOINE (1768-1800), a French general, born of a noble family, near the village of Ayat in Auvergne. He entered the regiment of Brittany as a sub-lieutenant, and did good service under Pichegru in 1792. Two years later he distinguished himself in the army of the Rhine under Moreau, and held out bravely for some time in the fortress of Kehl. In 1797 he was with Bonaparte in Egypt, and did much towards the subjugation of Upper Egypt, penetrating as far as the first Cataract. He was much respected by the natives, who called him the Just Sultan. In Italy he commanded the Corps de Reserve, and decided the battle of Marengo by his opportune appearance and brilliant charge. But he lost his life, being mortally wounded by a cannon shot. His integrity and freedom from self-seeking caused him to be universally beloved and Napoleon described him as being "un caractère tout-à-fait antique."

Desbarres, JOSEPH FREDERICK WALLEY (1722-1824), an English soldier and hydrographer, descended from a Huguenot family settled in England. Educated at Woolwich Academy, he

joined the 60th Regiment, and went with it to America. He was first employed against the Indians, whom he subdued. He was present at the siege of Quebec in the capacity of aide-de-camp to General Wolfe. After being entrusted with the fortification of Quebec, he undertook the survey of the river St. Lawrence. He then took part in an expedition to Newfoundland, and then made researches in Nova Scotia. At the outbreak of the War of Independence operations were embarrassed by the want of accurate maps of the American coast, and in 1777 Desbarres revised the existing maps, issuing an edition called *The Atlantic Neptune*. In 1784 he became governor of Cape Breton Island, and in 1804 he was made governor of Prince Edward Island, being then 84 years old. He died at Halifax at the age of 102. From him Captain Cook learned navigation.

Descartes, RENÉ (1596-1650), a French philosopher, who, from his influence upon later thought, has been called the father of modern philosophy. He was born at La Haye in Touraine, and was educated at the Jesuit college of La Flèche, where he displayed much talent. He entered the army, serving in Holland and Bavaria. In 1621 he left the army, and then after a period of travelling he settled in Holland, where he gave himself up to the study of philosophy. Finding the scholastic philosophy unsatisfactory in method and barren of results, he set about the discovery of truth. His first step was to divest himself of all preconceived ideas, and to take reason only as the test of truth. He concluded that the one proof of existence and the first established fact was consciousness of self. Hence his famous dictum, "*Cogito ergo sum*," which occurs in his *Meditations de Prima Philosophiâ*. The soul, not the body, is the important part of man, not being limited by extension in space, but being free and immaterial. Not every perception of the soul is perfect, but this imperfect perception leads to and implies the idea of a perfect being, a supreme intelligence whence proceeds all knowledge of truth. The essential nature of the soul is thought, that of the body, extension. Animal bodies are automata, worked by "animal spirits," themselves material, located in the nerves and set in motion by the action of external objects. Descartes saved free-will by supposing that in man, the soul residing in the pineal gland could change the direction of these spirits. [MALEBRANCHE.] Descartes maintained the doctrine of innate ideas. In physics Descartes studied much, and his theory of "vortices," or violent but regular commotions of the ether which account for the movements of the planets, was widely prevalent until upset by Newton's theory of gravity. In mathematics he made valuable discoveries, and was the chief founder of the science of analytical geometry. He also developed the theory of equations. It is noticeable that he never broke with Catholicism. In 1647 he was granted a pension by the French Court, and in 1649 he was invited by Christina, Queen of Sweden, to Stockholm to give her instruction, but the rigour of the northern climate soon killed him.

Descent (from the Norman-French *discent*) is the rule of law, pursuant to which, on the demise of the owner of an estate of inheritance (i.e. a fee-simple or freehold estate), he having made no disposition thereof by will or otherwise, it descends to his heir. Inheritance is a somewhat analogous word to descent, it signifying what may be taken by descent. The law with regard to this subject, and which regulates all descents taking place after the 1st of January, 1834, is prescribed by the Statute 3 and 4 William IV., c. 106. It has been well said that estates descend from ancestor to heir as the blood trickles. Property is acquired *in two ways only*, viz. by purchase or descent; if acquired by will, gift, grant, devise, or otherwise than by descent, it is in legal language acquired by purchase. Descent or hereditary succession is the title by which anyone acquires an estate in land as heir-at-law of a person deceased. In the lifetime of that person there can be no descent, and therefore no heir, though there may be an heir-apparent or an heir-presumptive. An heir-apparent is one who must be the heir if he survive to inherit. An heir-presumptive is one whose inheritance may be defeated by the birth of a nearer heir.

The following are the canons which at present regulate the descent of lands:—

(1) The inheritance descends to the lineal descendants of the purchaser *in infinitum* (see above remarks as to the meaning of the word "Purchaser").

(2) And to the male issue in preference to females.

(3) And to the eldest male issue in exclusion of the others [PRIMOGENITURE], but if there are no male issue, then to female issue altogether. [CO-PARCENTERS.]

(4) Lineal descendants *in infinitum* are to represent their ancestor. [REPRESENTATION.]

(5) Failing lineal descendants of the purchaser, the inheritance is to go to the nearest lineal ancestor, the father succeeding before the brother or sister of the purchaser, and every more remote ancestor succeeding before his issue other than any less remote ancestor or ancestors and his or their issue.

(6) In the application of the fifth canon the succession is to be according to the following order:—

(a) The father and all male paternal ancestors and their descendants *in infinitum*.

(b) All the female paternal ancestors and their heirs.

(c) The mother and all male maternal ancestors and her and their descendants *in infinitum*.

(d) All the female maternal ancestors and their heirs.

(7) The half blood of the purchaser shall inherit:—

(a) Where the common ancestor is a male next after a kinsman in the same degree of the whole blood and the issue of such kinsman *in infinitum*, and

(b) Where the common ancestor is a female next after that female.

(8) In the application of the sixth canon:—

(a) In the admission of female paternal ancestors the mother of the more remote male paternal ancestor and her heirs are to be preferred to the mother of the less remote and her heirs.

(b) In the admission of female maternal ancestors the mother of the more remote male maternal ancestor and her heirs are to be preferred to the mother of the less remote one and her heirs.

(9) Failing the discovery of an heir after the application of all the first eight canons, the land is to descend to the heir of the person last entitled, although he was not the purchaser thereof; and such heirs will, of course, have to be ascertained by the renewed application of the first eight canons, starting only from a different point of departure or propositus.

Estate Tail. The descent of an entailed estate or, in legal language, an estate tail, which is an estate limited to a person and the heirs of his body, follows the first four canons, unless it is barred, or unless it is limited to special heirs or to males or females, in which case the canons govern its descent, so far as they are applicable. [ESTATE TAIL.]

Customary Descent. such as Gavelkind and Borough English, are regulated by the customs of particular districts, and are exceptions to the above canons of descent so far as the respective peculiarities of those customs are concerned. [COMMON LAW (Particular or Special Customs), BOROUGH ENGLISH, GAVELKIND.]

Descent, Theory of [DARWINISM, DEVELOPMENT, EVOLUTION.]

Deschamps, EUSTACHE (1820 to circa 1400), a French poet, as to whose name there is some doubt, since *Deschamps* was an epithet denoting his origin, and the name *Morol*, which was also applied to him, is thought to have had its origin in his swarthy complexion. After studying law, philosophy, and astronomy at Orleans, he travelled in Europe, Asia, and what was then known of Africa. He took part in the war with England, and was so indignant at having his property overrun and plundered by the English that he lost no opportunity of satirising the English nation in his poetry. He married, but his married life seems not to have been a success, since up to the age of 90 woman and marriage were to him favourite objects of satire. His works were numerous, and as he created the ballad, or at least laid down rules for its composition, he may be fairly considered to have a better claim to the title of Father of French poetry than Charles d'Orleans, upon whom it is generally bestowed.

Desertion. 1. The crime of abandoning the naval or military service without licence. 2. The term also legally signifies the abandonment of a wife, which is a matrimonial offence, as is also the case where the wife leaves her husband, and for which a sentence of judicial separation may be obtained if the desertion has been for two years and upwards without cause; and by the Married Women's (maintenance in case of desertion) Act, 1886, a deserted

wife may obtain an order from justices of the peace for payment by her husband of a weekly sum, according to his means, not exceeding £2. 3. The abandonment or desertion of young children has also been provided against by an Act of Victoria's reign, by which anyone unlawfully abandoning or exposing any child under two years of age in such manner that its life or health is endangered or likely to be permanently injured shall be guilty of misdemeanor and punishable by penal servitude for five years, or imprisonment, with or without hard labour, not exceeding two years; and for better protection of infant life, a later statute makes it unlawful for anyone to retain or receive for hire or reward more than one infant (or, in case of twins, more than two) under the age of one year for the purpose of nursing or maintenance, apart from their parents, for longer than 24 hours, except in some duly registered house; and in case of proved serious neglect of these provisions, or that the person registered is incapable of supplying the infants with proper food, or that the house has become unfit for the reception of infants, the house may be struck out of the register, and any offence under that Act may be prosecuted summarily, and on conviction the punishment may be imprisonment for not more than six months with or without hard labour, or a penalty not exceeding £5.

Desiccation, the process or processes by which a substance, which may be either solid, liquid, or gaseous, is freed from accompanying moisture. For solids, heat alone is the most common mode of accomplishing this, steam or air ovens being generally employed. The action may also be accelerated by the passage of a current of hot dry air over the solid. In cases where heating is inadmissible, the drying may be effected by placing the substance in an exhausted vessel containing also a quantity of some desiccator. Liquids are generally allowed to stand over, or shaken with, some substance which combines readily with water, but does not act upon the liquid in question. The chief of such substances—*desiccants* or *desiccators*—in ordinary use are metallic sodium, phosphorus pentoxide (P_2O_5), sulphuric acid, calcium chloride, and quicklime. Gases are usually dried by passing through tubes containing one or other of the above *desiccants*. The commonest forms of such *drying-tubes* are U-tubes containing pieces of pumice saturated with sulphuric acid, or loosely filled with calcium chloride.

Desman. [MUSK RAT.]

Desmids, a group of chlorospermous algae, in many respects resembling the brownish and siliceous diatoms (q.v.). They occur in pools and streams, and consist typically of loosely-connected chains of unicellular joints, or individuals, increasing, as in diatoms, by each pair of joints producing two new half-joints between them, and so on, each joint consisting of an older and a newer half. The chlorophyll which they contain is often confined to stellate or banded portions of the protoplasm. Conjugation takes place in many forms, either on contact or by the putting out of tubes, and results

in the formation of a large resting-spore. Desmids have no known economic application.

Desmoines, a town of the U.S., capital of Polk county, and of the state of Iowa, on a river of the same name, 380 miles W. of Chicago. The town contains some good public buildings, and possesses extensive manufactures. There are coal mines in the neighbourhood. DESMOINES RIVER rises in a group of lakes in the S.W. of Minnesota, and flows S.E. for 300 miles into the Mississippi, four miles below Keokuk. It is the largest river of Iowa, and for 20 miles above the junction it forms the frontier between Iowa and Missouri.

Desmotropy, Desmotropism. Certain chemical compounds appear in different conditions to possess different *constitutions*. [CHEMISTRY.] Thus the body in most of its reactions appears to have a certain constitution, the *stable* form; but other reactions can only, or best, be explained on the assumption of a different constitution, the *labile* form. To this remarkable phenomenon Victor Meyer gave the name *desmotropy*. It is more frequently known as *tautomerism*.

Desmoulins, BENOÎT CAMILLE (1760-1794), a pamphleteer, journalist, and orator of the French Revolutionary period. He was born at Guise in the province of Picardy, the province that produced Peter the Hermit, Calvin, the Guises, and St. Simon. He obtained an exhibition at the Collège of Louis le Grand, and here he had Robespierre as a fellow-exhibitioner. A study of the history of Athens and of Rome gave them an admiration of republican institutions, and the contrast of what they read with what they saw around them in the corrupt French Court confirmed them in their views. Desmoulins studied law and became an advocate, but a stammer prevented him from practising in court and he turned his energies to writing. His work, *France Libre*, has been called "le chant de l'alouette gauloise saluant l'Aurore de la liberté." He helped found the club of Cordeliers, and he it was who in 1789 fired the people with the enthusiasm that culminated two days later in the taking of the Bastille. Although he voted for the king's death he was an advocate of moderation, and with Danton opposed the reign of terror. Although he had been a pioneer of the revolution, his services to the cause did not prevent his being arrested, tried, and executed, though he pleaded his services on the way to execution. He died at the age of 33. His wife Lucile made great efforts to save him, but she herself was beheaded ten days later.

De Soto, HERNANDO (1496-1542), a Spanish explorer, who went to the New World under Davila and Pizarro, and had a great share in the conquest of Peru. In 1536 he took part in an expedition to Florida, and penetrated to the Mississippi. He, however, contracted a fever and died there.

Des Perriers, BONAVENTURE (circa 1499-1544), a French poet and philosopher, born at Arnay-le-Duc in Burgundy. He was educated in a monastery, and seems there to have imbibed a hatred of monks and of religion generally. He obtained a post in the household of Margaret of Valois, and is

thought to have probably had a hand in the production of the *Heptameron*. At any rate in the witty Court he was in his element, and his scepticism found there a ready welcome. The King of Navarre, however, took a dislike to him, from what cause is not exactly known, and expelled him from the Court. His satirical *Cymbalum Mundi* was condemned by the authorities of the Sorbonne, and, with no less heartiness, by Calvin. A French critic has said that the most prominent men of the early part of the 16th century were Rabelais, Morot (Deschamps), and Des Perriers, and that none of them was inferior to the others.

Dessalines, JEAN JACQUES (*circa* 1760-1806), an Emperor of Hayti, was born in Africa, and till 1791 was a slave. He was set free in 1794 with the other slaves in St. Domingo, and had great influence with his fellow-insurgents through his skill in war, his courage, and his unscrupulousness. After the deportation of his chief, Toussaint l'Ouverture, and the evacuation in 1803 by the French Government, he was made governor-general for life with dictatorial power, and in 1804 he made himself emperor. His savage disposition and oppressive habits made him hated, and both troops and people conspired against him. He was killed by a soldier who succeeded him as emperor. Michael Scott, in *Tom Cringle's Log*, gives a good idea of the condition of Hayti at this period or a little later.

Dessau, a German town, capital of the Duchy of Anhalt, in a beautiful valley upon the left bank of the Mulde. It is well built and has fine squares and handsome buildings, among which is the ducal palace with a good picture-gallery and an interesting collection of antiquities. There are manufactures of woollens, woollen yarn, carpets, machinery, and tobacco.

D'Estrées, JEAN, Admiral of France, son of the marshal François Duc D'Estrées, who died in 1670, was born in 1624 at Paris. He saw much service in the West Indies, where he retook Cayenne from the Dutch, and in the Mediterranean, where he bombarded Tripoli. He died in 1707. It was this commander who, in 1672, at the battle of Solebay, left James, Duke of York, to bear the brunt of the action with the Dutch, and so rendered the engagement indecisive.

Desuetude, a Scottish law term signifying that long usage with public consent has practically effected the revocation of a previous legal enactment. The word has no signification of this kind in English law, where a statute must be repealed or modified (by statute subsequently passed) to be rendered inoperative. There are, however, several statutes that have become practically obsolete in England.

Determinants, in *Algebra*, the name given to a modern extension in notation, of much value in obtaining solutions of sets of unknown quantities, and in expressing certain symmetrical expressions compactly.

Detroit (*Fr. détroit*, a strait), so-called from its situation on the strait which joins Lake St. Clair

and Lake Erie, is a port, and the largest city of Michigan. The site rises gradually from the water-side, and the town is generally well-built and has some fine public buildings. It is in a flourishing condition, being centrally placed for trade, and being also in the direct track of Western emigration. The harbour is one of the finest in the United States, and is deep enough to receive the largest vessels. There are many industries, the chief of which are saw-mills, flour-mills, ship- and boat-building, foundries, tanneries, blast-furnaces, pork-curing, tobacco and cigar making, breweries, and locomotive-building. The French formed a settlement here in 1701. The DETROIT RIVER or Strait of St. Clair is 28 miles long, $\frac{3}{4}$ of a mile wide opposite Detroit, increasing in width lower down, and is navigable for the largest vessels. A tunnel has been projected beneath the river at Detroit to connect the American and Canadian sides, thus giving more direct railway communication between Quebec, Toronto, and Chicago and the Far West than exists *via* Sarnia and Port Huron.

Dettingen, a small German town in Bavaria, on the right bank of the Main, chiefly memorable for the fact that here a King of England last made his appearance on the battle-field in the person of George II., who, in 1743, with an army of English, Hanoverians, and Austrians, opposed and beat a French army under Marshal the Duc de Noailles.

Deucalion, the Noah of classical mythology, who, when Zeus drowned the world, entered into a ship, and after floating for many days landed on Mount Parnassus. He was accompanied by his wife Pyrrha, and the pair being bidden by Themis to re-people the world by casting behind them the bones of their mother, solved the riddle by casting stones from mother earth. Those cast by Deucalion became men, those by Pyrrha women. Deucalion was son of Prometheus, and father of Hellen, the founder of the Hellenic race.

Deuteronomy (*Gk. the second law*), the fifth book of the Pentateuch, containing three addresses of Moses to Israel before the passage of Jordan, with certain of his last acts and words. It is hardly, as the title implies, a repetition of the law, which is more elaborately given in Leviticus. Some Hebrew scholars (*e.g.* Gesenius and Ewald) have regarded it as later than the rest of the Pentateuch; others (as Wellhausen) identify it with the "Book of the Law" found by Hilkiah (2 Kings xxii.), and suppose it to have been composed shortly before that date. Neither hypothesis is precisely verifiable. According to the supporters of the latter, the blessing of Moses (*Deut. xxxiii.*) is much earlier than the rest.

Deutsch, EMMANUEL, the celebrated Hebrew scholar, was born in 1829 at Neisse. He became an assistant in the British Museum in 1855. His researches in Hebrew literature, his treatise on the *Talmud*, gave him a high place among scholars of the day. He died at Alexandria in 1873.

Deutschia, a favourite genus of shrubby plants of

varied size belonging to the order *Philadelphæa* (related to the *saxifragæ*). The clustered flowers have a campanulate calyx of five sepals; five petals, generally white, beneath an epigynous disc; ten stamens with flat filaments; and an inferior three- to four-chambered ovary, with distinct styles. The fruit is capsular. The simple leaves are interesting microscopically from their stellate hairs, which are so rigid that the leaves of *D. scabra* are used in Japan for polishing purposes. Several species are commonly cultivated.

Devanagari (i.e. *divine writing*), the Hindu name of the Sanscrit alphabet, which is now commonly believed to be of Phœnician origin. The oldest extant forms are those occurring on the rock inscriptions of King Asoka about the third century B.C. Since that time the letters have undergone considerable change, still further removing them from their Phœnician prototype, from which the system also differs in that it is written like the European alphabet of the same origin, from left to right, whereas the Phœnician ran from right to left. The complete alphabet consists of 50 letters (16 vowels and 34 consonants), besides a large number of double and even treble forms, somewhat after the manner of our monograms, which, however, are not now much used in printed Sanscrit works. But the vowels, when following the consonants, are combined with them, losing their independent forms, and giving rise to a syllabic system, in which each consonant, combining with the 16 vowels, forms 16 syllables, thus: *ka, kû, ki, kî, ku, kî, ka*, etc. In the alphabet the vowels, including two diphthongs, are placed first in a group by themselves. Then follow the consonants in groups of five, arranged on strictly phonetic principles; gutturals, dentals, labials, etc., by themselves, each surd followed by its sonant, and both by their aspirates and corresponding nasals. Thus the surd guttural *k* yields the series *ka, kha, ga, gha, nga*; the dental *t* in the same order yields the series *ta, tha, da, dha, na*; and so on. In this respect Devanagari differs altogether from the European alphabets, which still roughly retain the inorganic order of the Cadmean system, though the Indian and Western agree both in writing from left to right (Greek and Italic originally ran from right to left, and then both ways), and in developing true vowels from the Phœnician breathings. With the development of Hindu culture, the Hindu writing system has spread not only throughout India and Ceylon, but also to Tibet, Indo-China, the Eastern Archipelago, and the Philippine Islands. Thus Devanagari, in endlessly modified form, is the parent of all the numerous modern Indian alphabets, both neo-Sanscritic and Dravidian, as well as of the Tibetan, Burmese, Siamese, and Khmer (Cambodian) in Farther India, of the Rejang, Batta and others in Sumatra, of the Kavi and Javanese in Java, of the Bugi and Mangkassara in Célèbes, of the Tagala and Bisaya in the Philippines. Doubtless, also, to the same source will ultimately be traced the still undeciphered writings of Easter Island and some other Polynesian islands. Devanagari never

penetrated north-westwards into Irania, which was already supplied with scripts derived either from Phœnician or from the Cuneiform systems. For the same reason it was excluded from Central Asia, Mongolia, Manchuria, China, Corea, and Japan, where other cultures prevailed.

Development, the spontaneous production of progressive diversity, is a universal phenomenon, dependent on what Mr. Herbert Spencer has termed the instability of the homogeneous. The influence of surrounding forces, varying in their co-operation or opposition, and the mere summation of effects from the repeated action of the same causes, tend to modify things, to make them unlike what went before. This process, acting under natural law, is development. It has been suggested that the substances we know as elements may have developed from some one primitive form of matter. "While the matter composing the Solar system has been assuming a denser form, it has changed from unity to variety of distribution. Solidification of the Earth has been accompanied by a progress from comparative uniformity to extreme multiformity. In the course of its advance from a germ to a mass of relatively great bulk, every plant and animal also advances from simplicity to complexity. The increase of a society in numbers and consolidation has for its concomitant an increased heterogeneity both of its political and its industrial organisation. And the like holds of all super-organic products—Language, Science, Art, and Literature." (Spencer.) Among the laws of this development we can only here allude to a few. Carl von Baer's principle of the parallelism of *ontogeny*, or the course of development of the individual, with *phylogeny*, or the course of development in the race, gave importance to the study of embryology as throwing light on the succession of organic forms in time. Darwin and Wallace showed the tendency of organisms to vary indefinitely from their original type; and Wallace has shown that individual variations may be of considerable extent. Cope's law of acceleration of development indicates the inheritance of characters arising by "spontaneous" variation at slightly earlier stages in the development of the individual in each successive generation. Döhrn, Lankester, and others have emphasised the fact that degeneration (q.v.), and even atavism or reversion, may and do occur as concomitants of a system of increasing diversity which may more often result in advance. The facts of variations occurring in several directions from one stock, and of the whole series having, as we often find among fossil forms, become extinct, militate against the idea of a necessary innate perfectibility in all organisms, such as was maintained by Lamarck and Nägeli. The evidence of palæontology (q.v.), though necessarily fragmentary, points clearly to a gradual development of organic life in its now infinite variety and in its marked geographical provinces. For development of the embryo, see EMBRYOLOGY, MESOBLAST.

Deventer, an ancient town of Holland, in the province of Overijssel, 8 miles north of Zutphen, at the junction of the Schipbeek and the IJssel. It has played a memorable part in history, and was at

one period an important Hanse town. The church of St. Lievin is noted for its Roman crypt. Erasmus went to school in this town. The principal productions are carpets, cast-iron goods, printed cottons, hosiery, and a kind of cake called Denterkoek. A good deal of butter is exported.

Deviation. A mariner's compass should lie in the magnetic meridian, but neighbouring masses of iron and steel will cause some deviation from this position. It is often difficult to avoid this, though the consequences of an unknown deviation of the needle may be very serious. If possible, the compass should be placed far from all such magnetic matter as steel or iron; and if this cannot be done, suitable bars should be so adjusted as to neutralise their deviating influence.

In *Optics*, deviation means the change in direction of rays or waves of light by reflection or refraction. If, for example, light strikes a mirror at an angle of 45°, a deviation of 90° is produced by the reflecting surface. By reason of the deviation of light in passing obliquely through the atmosphere we are sometimes able to see the moon before it is actually above the horizon.

Devil Fish, a popular name for Rays of the family *Myliobatidæ*, generally of large size, from temperate and tropical seas. Those of the genera *Cephaloptera* and *Ceratoptera* sometimes attack and capsize boats. The name is also applied to the Angler and the Octopus (both which see). [RAY.]

Devil's Bridge, a name often bestowed upon bridges in difficult positions and hardly accessible places. The most noted is that over the Reuss, in Switzerland, on the road over the St. Gothard, between Germany and Italy. It is of stone, and extends for 75 feet from mountain to mountain, and takes the place of an older bridge situated higher up. There is also a noted Devil's Bridge in Wales.

Devil's Coach Horse (*Ocyrops oleus*, Linn.) is one of the largest and best known of the *Staphylinidæ*, or "Rove Beetles." It is very common in English lanes and fields, and can be readily recognised by the defiant attitude, with head and tail thrown well up, which it assumes when alarmed. It can inflict rather a sharp bite.

Devizes (from Roman *Dirisan*, the border spot), a municipal borough, market, and assize town of Wiltshire, nearly in the centre of the county, of which it is the second capital, and situated upon the old Bath and London road, at an elevation of 500 feet upon the flat top of a hill which forms a tableland to the W., and having from this circumstance a bracing air. The town is two miles long and one mile broad, and its streets, though irregular, are well paved. The Market Cross has an inscription commemorating the death of one Ruth Pierce, who was a modern Sapphira both in habits and ending. The chief industries are agriculture, the manufacture of implements and engines, and malting. The Kennet and Avon Canal passes Devizes, and surmounts the hill by the aid of twenty-nine locks. There was an ancient castle, from which in the 12th century the Empress Maud escaped in a coffin. There was an engagement here

in 1643 between the Parliamentary general Waller and the Royalists under Lord Wilmot, and Cromwell had the castle dismantled. On Roundway Down in the neighbourhood is an ancient earthwork. Sir Thomas Lawrence, P.R.A., was a native of the town. Pop. (1901), 6,532.

Devonian Age. [DEVONIAN SYSTEM.]

Devonian System, so named by Murchison and Sedgwick from its occurrence in Devonshire, is a great series of sandstones, greywackes, slates, limestones, and associated volcanic rocks, 10,000 feet thick, between the Silurian and Carboniferous systems. It represents the more truly marine or open-sea type of deposits, on the whole contemporaneous with the Old Red Sandstone of other areas; but neither its passage downwards into the Silurian nor upward into the Carboniferous is well developed in England. It extends over Devon, Cornwall, Brittany, Belgium, the Rhine valley, the Harz, and the Alleghanies. Devonian rocks similar to those of Belgium are found in deep borings under London. The system includes valuable ornamental marbles and the *killas* or slate of Cornwall, the matrix of veins of lead, tin, copper, and iron, which metals are also worked in the Harz district. The fauna of these rocks includes the last few graptolites; numerous corals, especially *Calceola sandalina*; crinoids; trilobites, less varied than those of the Silurian; no less than 1,100 species of brachiopods, which class is represented by *Stringocephalus Burtini* and *Spirifer disjuncta*, and reaches its culmination during this period; ammonitids, such as *Goniatites*; nautilids, such as *Orthoceras*; and occasional remains of fish identical with those of the inland-water deposits of the Old Red Sandstone. The system in Europe is subdivided as follows:—

Upper. *Condruasian* or *Famenian* of Belgium, with the Cypridina shales, and the Filton, Pickwell Down, and Cockington beds of Devon, and the Upper Old Red Sandstone of Scotland.

Middle. *Eifelian*, including the *Frasnian*, *Rhynchonella cuboides* beds, and Ramsleigh Limestone, and, below them, the *Givetian*, *Stringocephalus* Limestone, and Plymouth and Ilfracombe Limestone.

Lower. *Coblentzian*, *Taunusian*, and *Gedinnian*, the Lynton group of Devon and Lower Old Red Sandstone.

Devonport, a municipal and parliamentary borough and port of Devonshire, returning two members to Parliament. It is on the Hamoaze, a part of the estuary of the Tamar, and forms one continuous town with Plymouth. It is protected on the N.E. and E. by a bastioned wall and a ditch cut in the solid rock, and heavy batteries on Mount Wise defend the sea approach. The town is a naval and military station, and has royal dockyards, to the presence of which it owes its prosperity, since there are no special industries save those connected with the dockyards and the military and naval requirements. Pop. (1901), 69,674.

Devonshire, the most extreme but one of the south-west counties of England, situated between the English Channel and the Bristol Channel, having Somerset to the N.E., Dorset on the E., and separated from Cornwall on the W. by the river

Tamar. The county contains over a million and a half of acres, and is thus next in size to Yorkshire and Lincolnshire, and has a population of between six and seven hundred thousand. The scenery is very diversified, and the climate, though bleak on the uplands, is very mild on the south coast, where the myrtle, the orange, and the citron flourish in the open air. The coasts are rocky and indented, having Bideford and Morte Bays on the N. and Start and Tor Bays on the S. Dartmoor in the south is a wild tract interspersed with bogs and mosses, having an area of 22 miles by 14, and rising to a height of over 2,000 feet. The island of Lundy in the Bristol Channel is $2\frac{1}{2}$ miles long by 1 broad, and contains 920 acres. This belongs to the county, as does also Drake's Island, a fortified islet in Plymouth Sound. For political purposes Devonshire has eight divisions, each of which returns one member to Parliament. After the capital Exeter, which is the cathedral town, the principal towns are Plymouth, with Devonport and Stonehouse, Tiverton, Tavistock, Barnstaple, and Bideford. Geologically, Devonshire has a sandstone formation in the N. and S., while the basin between them is of carboniferous rock, through which the igneous rock breaks in the south to form the granite tors of Dartmoor. Exmoor in the N. has in Dunkery Beacon the next highest point to Dartmoor. The Northam Burrows in the N. is a curious formation of grass-covered sand bounded by pebble ridges. The central part, called the Vale of Exeter, is very fertile, and forms rich tillage and grazing grounds, producing the cream, butter, and cider for which the county is famed. West Devon resembles Cornwall, and is for mining purposes under the Stannary Act; the "forest" of Dartmoor belonging to the Duchy of Cornwall. It produces copper ore, tin, iron ore, and other minerals, besides potter's clay and china clay. Attempts have been made to exploit profitably the peat stores of Dartmoor and Exmoor, but these have not met with much success. Among the industries are the making of gloves and tanning, and the numerous harbours and seaports give great facilities for fishing. The dockyards of Devonport and Keyham also employ many hands. The principal rivers are the Exe, Torridge, Taw, Plym, Teign, and Tamar, with their many tributaries. Large vessels can ascend the Tamar for five miles from Hamoaze. Owing to the multitude of streams, Devonshire is rich in water power. The boulders of the moorlands seem to belong to a period of glaciers, though no marks of glacier action are to be traced. There are caves with remains of animals and traces of man of the Palaeolithic and Neolithic ages, raised beaches, and buried forests. There are many traces of the Romans, among them 500 stations that can be traced, and roads which bear generally the names of ways, paths, or ridges. Few counties are better known than Devonshire; the mild climate, the beautiful scenery, the fact of its having produced many of the naval heroes of the 15th and 16th centuries, have made it the favourite hunting ground of tourists. Kingsley, Black, Blackmore, and Whyte Melville have combined to familiarise us with its features. Pop. (1901), 663,827.

Devonshire, DUKE OF. [CAVENDISH.]

Devrient, LOUIS (1784-1832), a German comedian born in Berlin. He was put to a trade, but having a strong liking for the stage he ran away. His first stage appearance was in 1802. His disorderly habits soon landed him in difficulties. He married Margaret Heefe, and coming to Berlin he made the acquaintance of the actor Iffland, whose successor he became. He played the part of *Franz Moor* in Schiller's *Robbers*, and was a favourite actor for seventeen years. His success was chiefly owing to his great power of throwing himself into his parts. His death was hastened by drink.

Dew is water-vapour condensed into small drops on cool surfaces exposed to the air. Much curious theorising has been indulged in by older physicists as to the nature of dew. The correct principles were first advanced in 1814 by Dr. Wells. The air always holds a certain amount of water-vapour, derived from all the exposure of water on the surface of the earth. For every temperature there is a definite quantity of water-vapour that may be held in a cubic foot at a given pressure; if the temperature be at all lowered, liquid water begins to be deposited; if raised, more vapour may be introduced. At that temperature the air is said to be saturated, for under those conditions it can hold no more vapour. If the air be not saturated with moisture, by lowering its temperature sufficiently a point is reached when further abstraction of heat will cause deposition. This temperature is called the *dew-point* for the air under those conditions of humidity. If there be very little vapour in the air, a sensation of dryness is experienced, and we find that the dew-point is considerably below the existing temperature. At night-time certain bodies radiate heat considerably, especially when the sky is clear and when the bodies have dull surfaces. They thus become very cold, and so may cool neighbouring layers of air down to the dew-point. Dew is deposited on them, and remains till the air becomes warmer, when it may evaporate again. Deposition is facilitated by very gentle wind, which conveys freshly-laden air to the cold surfaces; but stronger wind is liable to warm the condensing bodies, and to directly assist the evaporation of any dew that has been formed. [EVAPORATION.]

Dewas, a native state of Central India, consisting of two united states with two chiefs. Population 142,162. There is a capital of the same name.

Dewberry (*Rubus cæsius*), a prostrate white-flowered bramble, not uncommon in our woods and thickets, having the comparatively few drupels of the fruit covered with a blue-grey or glaucous waxy bloom, whence its name.

D'Ewes, SIR SIMONDS (1602-1650), an English antiquary and chronicler, born at Chardstock, in Dorsetshire. His father was a clerk in Chancery, and educated his son at Bury St. Edmunds grammar school, and at St. John's College, Cambridge. The son was called to the bar in 1623, but did not practise, being rich enough not to need the aid of

his profession. He projected a history of Great Britain, and made a valuable collection of notes and observations which now form part of the Harleian MSS. at the British Museum. Among these materials his *Journal of all the Parliaments of Queen Elizabeth* are of much value. D'Ewes became High Sheriff of Suffolk, and was created a baronet in 1641, and the next year he was returned to the Long Parliament, where he sat till 1648, when Pride's Purge dislodged him.

De Wet, CHRISTIAN, a general who greatly distinguished himself in the South African War (1899-1902). After the occupation of Pretoria and Johannesburg by the British troops and the annexation of the two Republican states, De Wet maintained for many months a successful warfare, inflicting losses on the British and evading all attempts at capture. In 1902 he took part in the conference at Vereeniging, which finally ended in terms of peace being agreed upon. Later in the year he came to Europe with Generals Botha and Delarey, to endeavour to raise funds for the Boers. His book on the *Three Years' War* appeared in 1902.

De Wette, WILHELM MARTIN LEBERECHEIT (1780-1849), a German theologian, son of a clergyman and born at Ulla, near Weimar. He was educated at the Gymnase of Weimar, and in 1799 entered the University of Jena. In 1807 he became Professor of Theology at Heidelberg. In 1810 he occupied a similar post at Berlin, but was banished in 1819 for manifesting sympathy with the assassin of Kotzebue. He returned to Weimar, where he prepared a work on Luther, wrote a romance, and displayed some talent for preaching. In 1822 he was appointed Professor of Theology at Basel, and died rector of the university there.

De Witt, JAN (1625-1672), a Dutch statesman. He was son of Jacob de Witt, burgomaster of Dort, and led the party that opposed the Prince of Orange. In 1652, two years after the death of William II., De Witt was made Grand Pensionary of Holland, in which office he was the great opponent of the Orange family, and made an effort to abolish the office of Stadtholder. In 1665 he was engaged in a war with England, which he carried on with vigour, and in 1672 a war between Louis XIV. and the Spanish Netherlands involved Holland. De Witt became very unpopular and resigned his office, and on the occasion of his paying a visit to his brother Cornelius, who was in prison on a charge of conspiring against the life of the Prince of Orange, the mob raised a tumult and murdered the two brothers.

Dewsbury, a municipal and parliamentary borough of the West Riding of Yorkshire, eight miles S.W. of Leeds, and in the heart of the woollen district. Though of great antiquity, and once an old Saxon ecclesiastical parish of 800 square miles, Dewsbury was of no great importance till its manufactures brought it to the front. Its specialities are heavy woollens, such as army, navy, police, and pilot cloths, druggets, rugs, blankets, and shoddy. It has iron foundries, boiler and

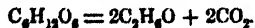
machine factories, and flour-mills. It sends one member to Parliament. Pop. (1901), 28,050.

Dextrin ($C_6H_{10}O_5$), an isomer of starch (q.v.), from which it is readily prepared. When starch is heated for some hours in an oven, or for thirty minutes to the temperature of $213^{\circ}C$. the grains swell, burst, and turn into a pale brownish substance known as torrefied starch, British gum, or commercial dextrin. It appears either in translucent masses or as a powder. With iodine it gives a fine purplish-red colour. On the addition of cold water to it the dextrin dissolves readily, forming a clear gummy solution, leaving behind some unaltered starch. This gummy solution is largely used in calico-printing and as a substitute for gum-arabic, as on our postage stamps. Dextrin being as insoluble in alcohol as it is soluble in water is precipitated from the solution on the addition of that substance, forming white flocculent masses uniting into translucent colourless lumps. This pure dextrine is not coloured by iodine. Dextrin is formed in baking, often constituting 10 per cent. of bread, and giving a glaze to loaves and biscuits. It is also formed from starch, and even from cellulose (q.v.), by the action of acids and of nitrogenous ferments (q.v.), or zymosis, such as diastase (q.v.), as in the germination (q.v.) of seeds, or that artificially stimulated germination known as malting (q.v.). Dextrin occurs, therefore, in beer. It has also been found in the flesh of animals. It is suggested that some ferment is present in every cell, and that the transformation of starch by its action into dextrin may be a widely important process of digestion preparatory to the transfer of the carbohydrate food to another part of the organism. [METABOLISM.]

Dextro-, as a prefix to the chemical names of substances, indicates that the substance in question acts on polarised light, being what is known as *dextro-rotatory*. [POLARISATION.]

Dextrose (GLUCOSE, or GRAPE-SUGAR) is a member of the group of carbohydrates (q.v.) termed *hexoses*—i.e. those containing six atoms of carbon in the molecule. It is found in honey and many fruits, and in small quantities in the blood and urine. In the disease diabetes the quantity present in the urine increases greatly, and may reach 10 per cent. It is formed, together with another sugar, *levulose* (q.v.), by boiling cane-sugar with acids, and also by the similar treatment of starch, or cellulose, which are the substances chiefly employed for its manufacture on the large scale. It may be obtained similarly, together with other products, from a class of bodies known as *glucosides* (q.v.). It is soluble in water, and is sweet to the taste, though not as sweet as cane-sugar. As ordinarily obtained it is dextro-rotatory [POLARISATION], but it has recently been shown that an equally active, *lævo-rotatory*, as well as inactive dextrose exists. Its composition is represented by the formula $C_6H_{12}O_6$, and it appears to be an *aldehyde* (q.v.), having a constitution $CH_2OH \cdot (CHOH)_4 \cdot CHO$. It has recently been artificially prepared, and its relations with other sugars shown. It undergoes

fermentation by the action of yeast, with the production of alcohol and carbon-dioxide :



For its quantitative estimation it is added to a definite quantity of a boiling standard solution known as *Fehling's solution* (q.v.) until the blue colour which this reagent possesses is completely discharged. It is also estimated by means of a form of polarimeter (q.v.) known as a *saccharimeter* (q.v.). [SUGARS.]

Dey (Turkish a maternal uncle), a term applied by the Janissaries (q.v.) to the commanders they elected. Tunis for about a century (till 1703) was governed by these commanders, as was Algiers for nearly two centuries previous to its conquest by the French in 1830.

Dhan. [DAAN.]

Dhang, aborigines of the western Ghâts, India, just south of the Tapti river in Khandeish. Their territory, from them called Dhang, has an area of about 1,000 square miles, with a population of 40,000, and is administered by hereditary chiefs under British protection. The Dhangs, i.e. "Highlanders," are still pagans, and mostly speak a Marathi dialect, though their physical traits and usages show that they are a branch of the Bhil race. [BHIL.]

Dhangar, a chief division of the Oran, or primitive people of Orissa, south-east Bengal, but found also in Behar and on the frontier of Assam; appear to be originally of Kolarian stock, but are now largely assimilated to the surrounding Aryans, and generally speak neo-Sanskritic languages—Oran, Bengali, or Assami, according to the districts in which they are settled.

Dhar, a native Mahratta state of Central India, of about 1,740 square miles in extent. The State is generally fertile, its chief products being wheat, rice, and opium. The capital, of the same name, is surrounded by a mud wall, and contains some striking buildings.

Dharwar, an Indian town in the Bombay Presidency, and capital of the Dharwar district. It is a straggling town, and possesses a considerable trade. It was protected by a fort, which is now in ruins. There are some military cantonments about two miles off. The district has an extent of 4,535 square miles.

Dher, or **DHERA**. 1. A low-caste people of Gujarat, West India, forming the very lowest and most despised section of the population in the Surat, Ahmedabad, and Baroda districts; physically, they can scarcely be distinguished from the Bhils (q.v.), of whom they probably are a branch, degraded by the slavery imposed on them by the Hindus for many ages. The Dheres live in scattered groups, occupying wretched hovels of foliage, and depending on the chase, fishing, and the carcasses of dead animals thrown to them by the Hindus. Some are workers in leather. 2. A people of the Talperu valley and Gadalguta Hills, left bank of the

Godaveri, Bastar district, India; are half-caste Gonds and Aryans, of Gond (Dravidian) speech. (Captain Holdich, *Proceedings Royal Geographical Society*, June, 1879.)

Dhimal, Hinduised communities in the Sal forest, Assam, and in Nepal; akin to the Kachari, but with distinct speech; related to the Mechi or Bodo of the eastern Himalayas (Dalton).

Dhole (*Canis primæus*), the Indian wild dog, sometimes placed in a distinct genus, Cuon. They are fox-like in appearance, and hunt in packs. Some have been reduced to a state of partial domestication, and are used for hog-hunting.

Dholka, an Indian town, is one of the oldest towns of Gujarat, in the Bombay Presidency.

Dholpore, a native state of Rajputana, in Central India, in the ancient province of Agra. It has an area of 1,200 square miles. The capital has the same name.

Dhwalagiri, one of the highest peaks of the Himalayas, on the borders of Nepaul and Thibet. Its name signifies "White Mountain," and its height is 26,826 feet.

Diabase, a dark green or black crystalline rock, occurring mainly in the earlier geological formations, and consisting of a plagioclase felspar, generally oligoclase, and augite, with or without quartz, olivine, apatite, and mica. There is usually more or less magnetite or ilmenite, and the augite has generally been to a considerable extent transformed into a viridite, or green decomposition-product, believed to be epichlorite. Diabase is accordingly considered to be an altered condition of some basaltic lava. It contains from 48 to 50 per cent. of silica.

Diabetes (from a Greek word signifying to flow through), a disease characterised by excessive secretion of urine. In *diabetes insipidus* no abnormal constituent is present in the urine secreted; in *diabetes mellitus*, however, a substance allied to grape sugar may be detected on examination of the urine. The former disease is very rare, and *diabetes mellitus*, or diabetes proper, will alone be further considered here. As regards the pathology of diabetes but little is known with certainty. The chief symptoms are increased appetite, uncontrollable thirst, wasting, dryness of skin, and the secretion of considerable quantities of urine, usually of high specific gravity and containing sugar. The disease in its most serious form is usually met with in young male adults; its progress in such subjects is apt to be rapid, and it generally proves fatal. Death is sometimes ushered in by coma (q.v.). Diabetes is not always an intractable disease; in middle-aged and elderly people particularly it often admits of considerable alleviation, if not of cure. The main form of treatment adopted is dietetic. All sugar-forming food is excluded from the patient's diet. He must rigidly abstain not only from sugar, but from starch, which is converted into sugar by the digestive juices. Gluten bread must be substituted for ordinary bread, and such articles of food as potatoes carefully eschewed. Glycerine has been

recommended in place of sugar for sweetening purposes, and since the discovery of saccharin, that drug has been largely employed. A form of treatment which has been highly recommended, but which is certainly not based on the exclusion of sugar-forming foods, is the milk treatment, in which the patient consumes nothing but milk. Certain preparations of opium seem to be of service in the treatment of diabetes.

Diablerets, a mountain group of Switzerland, situate in the Bernese Alps, between the cantons of Vaud and Valais. The highest point is 10,620 feet. There is much clay in the formation, and the result of glacier action upon this is to cause frequent and considerable landslips, the most considerable of which have been those of 1714 and 1749. In the case of the latter of these, the Liserne was choked, and its waters formed the small lake of Derborence.

Diadema, a genus of sea urchins and the type of the family *Diademidae*. The sub-genus *Pseudodiadema* includes a large number of species in the Oolitic and Cretaceous rocks. In an existing species eyes have recently been described.

Diæresis (Gk. *diærësis*, division), a mark (two dots) on the second of two vowels ordinarily forming a diphthong, to indicate that they are to be separately pronounced (e.g. "aërial").

Diagnosis, the art of distinguishing between different forms of disease. Diagnosis is based upon an analysis of symptoms (phenomena observed by the patient) and physical signs (phenomena observed by the physician). The methods employed in the detection and elucidation of physical signs have been greatly perfected within recent years. The methods of percussion of the chest, invented by Avenbrugger, and of auscultation, invented by Laennec, threw much light upon thoracic affections. Methodical examination of the urine has proved of the greatest service in detecting many forms of disease. Again, the laryngoscope and the ophthalmoscope, and the employment of electricity, have greatly perfected the means available for arriving at a correct diagnosis. The latest development of the art of diagnosis consists in the application of bacteriological investigation, as, for example, to the sputum of cases of suspected phthisis.

Diagonal, the line joining opposite corners of a polygon. It may be readily determined when the polygon is regular and with an even number of angular points, but if the figure is complex the rule is to join those corners which are separated by half the number of sides possessed by the polygon. When the number of sides is odd, the half is taken to the nearest figure; thus a diagonal of a heptagon, with seven sides, joins points separated by three sides travelling one way, and by four travelling the reverse way, round the figure.

Diagonal Scale, an arrangement supplied with most sets of scales for length measurement, for accurate estimation of small fractional lengths. It is not much employed practically. The principle is that if two lines are inclined to each other and

meet at any point, their divergence is perfectly uniform as we proceed from that point. If at a distance of ten inches from their intersection the distance apart of corresponding points on the two lines is $\frac{1}{10}$ th inch, then at a distance of one inch from their intersection the distance apart will be only $\frac{1}{100}$ th inch, and so on proportionately.

Dialectic (Gk. *dialektike*, conversation), properly disputation, used by the Sophists (q.v.) to exhibit their own skill; by Socrates (1) to expose his hearers' prejudices and so convince them of their ignorance; (2) to arrive at the nature of general conceptions such as virtue, justice, etc. (Xenophon says that Socrates, connecting the meanings of *dialogomai*, to converse, and *dialogein*, its active voice, to distribute, said that dialectic was so called because it "classed things according to their kinds.") Plato's dialectic is the science dealing with the real essences which enter into and constitute the true nature of the particulars in a class and are expressed in its definition. In one passage (*Rep.* vi., sub fin.) it is said to take up the fundamental ideas of the sciences (number, mass, motion, etc.) and explain their relation to one another and the supreme law of the universe or Idea of Good. (We need hardly add that this conception is not worked out.) Hegel's dialectic is that supreme process of thought which deals with and solves the difficulties and contradictions involved in fundamental ideas. [HEGEL, PLATO.]

Diallage, a variety of augite, crystallising in the oblique system, with more perfect cleavage than augite (q.v.), the same absence of pleochroism, and a pearly or sub-metallic lustre. Its crystals often contain numerous acicular microliths arranged in definite directions, and fluid-cavities. By ordinary transmitted light they are pale green or brownish yellow. With labradorite feldspar this mineral makes up the rockgabbro (q.v.). Its hardness is 4 and its specific gravity about 3.29.

Dials are instruments used for recording time by means of shadows derived from the sun or moon. They were of much importance before the invention of clocks and watches, but are now of little more than historic interest. The principle upon which dials are made is readily explicable, though in the case of dials constructed for various positions of pointer and plate, certain difficulties of detail manifest themselves. The earth rotates uniformly about its axis, thereby causing an appearance of uniform rotation of external bodies, such as the sun or other stars, about the earth. It is true that the earth is travelling in an elliptic orbit round the sun, with a speed not strictly uniform; but its motion once round its own axis is so much more rapidly effected than its motion once round the sun that we may disregard this latter in discussing the daily position of the sun as seen from the earth. Assuming, then, that the sun appears to swing round the axis of the earth at the constant rate of one revolution per day, it follows that any rod lying in this axis or parallel to it will throw a shadow that also swings uniformly round once per day. We cannot adjust a rod in the actual axis of the earth where it

may cast a shadow, but we can readily fix one parallel to the axis at any convenient spot on the earth's surface. We may also adjust a plate near the rod which shall exhibit the shadow and its motions. The plate is marked with lines showing the position of the shadow at the different hours of the day, the way in which the lines are drawn depending on the position of the plate. The marking is simplest when the rod or *gnomon*, pointing to the pole-star, is perpendicular to the plate or *dial-plane*; then the hour lines are at equal angular distances of 15° all round the dial. For the marking when the plate is vertical or horizontal, a little spherical geometry is required.

Dialypetalous. [POLYPETALOUS.]

Dialysis. Graham found that animal or vegetable membranes were impervious to some substances in solution, while others possessed the power of passing through such structures. All soluble substances he thus divided into two classes, *crystalloids* and *colloids*. The latter are those to whose solutions the membrane acted as an impervious wall, and examples of such substance are the gums, glue, precipitated silica, while the crystalloids include all substances of a crystalline nature as salt, sugar, etc. A colloid can be separated therefore from a crystalloid by placing the solutions in a small cup, the bottom of which consists of parchment, and floating it in a basin of water. The crystalloid passes into the outer water while the colloid remains in the cup. By repetition of this process—*Dialysis*—the separation may be made complete.

Diamagnetism, in *Physics*, denotes that branch of magnetism which treats of those substances which are repelled by the poles of a magnet, instead of being attracted like iron or steel. Among such diamagnetic substances we find bismuth, phosphorus, zinc, mercury, water, and air. Their repulsion from the poles of a powerful magnet is very slight, and is insignificant compared with the attraction of iron towards the poles. [MAGNETISM, INDUCTION.]

Diamantina, or TIJUCO, is a town in Brazil, the centre of a diamond district in the province of Minas Geraes. The inhabitants are almost all engaged in gold or diamond mining.

Diameter, in *Geometry*, a term employed generally in reference to the conic sections. Each of these curves possesses a centre (q.v.) a point which bisects all lines passing through it from one side of the curve to the other. Any such line passing through the centre is called a diameter. In the case of a circle the diameters are all equal. In the ellipse we have pairs of equal diameters; the longest and shortest are impaired and are called the major and minor axes respectively. In the parabola the centre is at an infinite distance and the diameters consequently parallel and infinitely long. In any conic, parallel chords are all bisected by the same diameter.

Diamond (named from the Greek *adamas*, unsubduable), the hardest of precious stones, being 10

in von Mohs' scale. It consists of pure carbon, burning in strong heat or in pure oxygen into carbonic acid gas. It is insoluble in acids. From graphite (q.v.) it differs in crystalline system and in transparency. The forms in which it occurs, the octahedron, rhombic dodecahedron, triakisoctahedron and hexakisoctahedron, as well as the rarer cube, all belong to the Cubic system. Some of the crystals are nearly spherical, having curved faces and edges. The mineral is rather brittle, cleaving readily parallel to the octahedral faces. Its specific gravity is 3.52. Diamond when at its purest is colourless, transparent, adamantine in lustre, with the high refractive index 2.42; but it also occurs grey, brown, blue, red, yellow, green, or black. Diamonds were formerly only obtained from the Deccan, where they occurred in recent derivative deposits, no original matrix being known. Since the beginning of the 19th century they have been obtained from Minas Geraes, Matto Grosso, and Bahia, in Brazil, in itacolumite, a quartzose mica-slate or metamorphosed sandstone, and in soil derived from it. Since 1867 diamonds have been largely obtained from Griqualand West and the Orange Free State, in South Africa, where the town of Kimberley has arisen, forty million pounds' worth having been exported since the first discovery. They were found at first in alluvial shingle; but subsequently in "pipes" of a shaley decomposed diabase, or closely related rock of igneous origin. The mode of origin of the mineral is by no means clear, and no satisfactory demonstration has as yet been given of its having, as alleged, been prepared artificially. Diamonds are cut and polished by means of a wheel armed with their own powder, the industry being carried on in Amsterdam and London. Three forms are cut, the *brilliant*, the *rose*, and the *table*. The brilliant consists of a double pyramid, the upper and more truncated half having a *table* or horizontal eight-sided facet, surrounded by a *bezel* or series of smaller facets, whilst the lower and more pyramidal half extending from the *girdle*, or common base of the pyramids, to which the setting is attached, is called the *collet side*, and terminates in a minute flat facet, the *collet*. The *rose* is flat on one side, with triangular facets, of which the central ones meet in a point on the other. The *table*, adopted only for thin stones, has two parallel, wide, tabular facets with rows of smaller ones between them. The weight of diamonds is reckoned by the *carat*, which is a little more than 205 milligrams. The price of brilliants of first quality as to colour or "water," well cut, but not of exceptional size, is reckoned at from £8 to £10 for the first carat, increasing as the square of the weight in carats, e.g. two carats, £32 to £40, three carats £72 to £90. Among the most celebrated large diamonds are the Orloff, in the Russian sceptre, 194½ carats; the Koh-i-Noor, 106½ carats, since the annexation of the Punjab in 1849 the property of the English Sovereign; and the Cullinan, presented to Edward VII. by the Transvaal Government in 1907. Besides its value as a gem, diamond is used by glaziers for cutting glass, and when imperfect in form and brilliancy, under the name of *bort*, for polishing. A

brownish black porous impure variety is found near Bahia, and is now used in boring wells, trials for mines, etc., several pieces of it being set round the margin of a revolving steel tube.

Diamond Beetle, a small Brazilian beetle, so called from its brilliant metallic colour. The elytra or wing cases are marked by spots of a fine golden green. It is a favourite microscopic object, and, as its colours are permanent, it is also used for various decorative purposes. Its zoological name is *Entimus imperialis*, Font.

Diamond Necklace, THE, in French history, gave rise to a scandal, which eventually intensified the feeling against the unhappy Marie Antoinette. The necklace, which was to surpass anything previously conceived, consisted altogether of 800 diamonds, in three triple rows, with a pendant in the form of a cross and crown, surmounted by the fleur-de-lis. Its value is estimated at between £80,000 and £100,000 sterling. The makers (Boehmer and Bassange, jewellers of Paris) offered it in 1783 to Louis XVI. for Marie Antoinette. She, however, patriotically declined it as too expensive. In 1785, however, M. Boehmer complained to a lady-in-waiting that the queen had not yet paid the first instalment of the price of the necklace, which he said she had bought privately through Cardinal de Rohan, a dissolute nobleman, lately ambassador at Vienna, who had been excluded from Court. This led to the discovery of an elaborate plot. One Madame de Lamotte, of noble descent but disreputable antecedents, had persuaded the Cardinal that by acting as intermediary for the queen in the purchase of the necklace he would be restored to favour, and by finding a woman to personate the queen and a man to personate a confidential servant, had obtained the necklace, the fate of which was never ascertained. De Rohan's enemies at Court prevented the scandal from being hushed up, and the persons implicated, including Cagliostro (q.v.), were tried in 1786. Madame de Lamotte was sentenced to be publicly whipped, branded, and banished, her husband condemned to the galleys (but he had escaped), the valet banished; the rest were acquitted. To the last many persons believed in the queen's complicity.

Diamond Sparrow (*Spermestes guttatus*), a cage-bird from Australia. Plumage shades of grey, a black band irregularly spotted with white on the sides, a patch of carmine on the tail.

Diana, an Italian goddess, chiefly of the Sabine and Latin races, afterwards identified with Artemis of the Greek mythology, whose bow and other attributes she assumed. The name is generally taken to be a feminine form of Janus. Horace, in his *Odes*, alludes to her threefold character of Hecate, Diana, and Phœbe, and calls her "*Diva triformis*," and speaks of her as presiding over maternity in her character as Lucina. She is not really identical with "Diana of the Ephesians," who was probably the same as Cybele.

Diana of Poitiers (1499-1566), DUCHESS OF VALENTINOIS, a noted Frenchwoman, descended

from the noble family of Poitiers in Dauphiné. At the age of 18 she married Louis de Brezé, Comte de Maulevrier, Grand-Seneschal of Normandy, and grandson of Agnes Sorel. Left a widow in 1531, she became the mistress of the Duke of Orleans, who succeeded to the throne as Henry II. in 1547. She had great influence over the king, and retained it till his death in 1559, holding her own with Catherine de Medici, who, moreover, had great respect for her. After the king's death she lived in retirement at her castle of Anet. She raised a mausoleum to her husband in Rouen cathedral, and her statue by Benvenuto Cellini is now at Paris, as is also a statue of her by Jean Goujon. She served as subject to many sculptors and painters.

Dianthus. [PINK.]

Diapason (Greek *dia pasōn*, through all, i.e. the strings of the lyre), a term originally applied to the musical octave. In French it means a tuning fork, as setting the pitch, then the pitch itself. In the organ (q.v.) the term is applied to the most important stops, which are in connection with the whole keyboard.

Diaper (Old Fr. *diaspre*, from Gk. *iaspis*, jasper), figured linen cloth, for napkins, etc. In architecture the term is applied to panelling filled up with a painted pattern, etc., or with carving in low relief.

Diaphoretics, drugs which increase the activity of cutaneous secretion and thus promote perspiration. The chief of these are pilocarpine, acetate of ammonium, senega, antimony, and camphor. A vapour bath is a most efficacious means of producing a diaphoretic action.

Diaphragm, the structure which divides the cavity of the thorax from that of the abdomen. It forms an arched dome with its concavity downwards, and contraction of the muscular fibres of the diaphragm by reducing the height of the dome increases the capacity of the chest. The diaphragm is thus the chief muscle concerned in inspiration. The diaphragm is attached posteriorly to the lumbar vertebrae by two ligamentous structures known as the pillars of the diaphragm, laterally its fibres take origin from the six lower ribs, and in front it is attached to the ensiform cartilage. Through the diaphragm pass the aorta with the thoracic duct and vena azygos major; the œsophagus, with the pneumogastric nerves, and the vena cava inferior.

Diarbekir, a town of Asiatic Turkey, and head of a pashalic of the same name, is situated on a high bank overlooking the Tigris, and is surrounded by a lofty wall now partly in ruins. It has archbishops of the Armenian, Syrian, and Chaldaic Catholic churches, and besides possessing a considerable trade has manufactures of iron and copper wares, and of leather, silk, woollen, and cotton goods. Armida was the old name, and the town is of great antiquity. It was restored under the Roman Emperors Valens and Valentinian, and was fortified

against the Persians by Constantine, and was taken by them more than once. The Turks obtained possession of it in the 12th century, and there are many traces of Arab inscriptions on the walls. Diarbekir is on the postal route between Constantinople and Bagdad.

Diarrhoea (from a Greek word signifying *to flow through*), a condition in which the intestinal discharges are more liquid, more frequent, and in larger quantity than is natural. Diarrhoea is frequently accompanied by vomiting and by pain or colic. The most common cause is the ingestion of some irritant substance. Warm weather is particularly associated with diarrhoea of this type, and it has been supposed that a temperature of 60° Fahrenheit and upwards tends to favour the production of some diarrhoea-causing poison which may enter the system in water and the like. Diarrhoea in some people arises whenever the system is below par; again, in other patients diarrhoea is a common occurrence as the result of exposure to cold. Disease of the intestinal wall (catarrh, ulceration, tubercular and cancerous disease) is usually accompanied by diarrhoea. Acute diarrhoea is generally best treated at the outset in adults by the administration of half an ounce of castor oil with ten minims of laudanum (in children opium, of course, should only be used under medical advice). The food taken should be of a bland, non-irritating character; it is better to avoid all solid food for a time. Milk, with the white of an egg beaten up in it, with the addition of a little brandy, is an excellent preparation. If the diarrhoea persists it may be necessary to resort to astringents. The summer diarrhoea of infants is oftentimes a very serious affection, and medical advice should be procured in the first instance. It is more common among children brought up by hand than in those having the breast. A useful form of treatment in the former case consists in the addition of a little barley water or some such farinaceous substance to the milk to break up the curd. Grey powder and bismuth are often of great service in the diarrhoea of infants. If collapse be extreme a warm bath is a useful plan of treatment. In chronic diarrhoea diet is a matter of great importance. Raw meat has often been employed with good results. Astringents innumerable may be employed. Kino, catechu, and red gum are probably the most useful.

Diastrase (from the Greek *diastēmi*, I separate), a name applied by Payen and Persoz in 1833 to a nitrogenous ferment present in germinating seeds and perhaps in the cells of other parts of plants. It has never been satisfactorily separated or analysed; but its discoverers stated that it formed $\frac{1}{100}$ th of the weight of malt and that it is capable of bringing about, by an action which cannot be said to be understood, the transformation of 2,000 times its own weight of starch into sugar. Other albuminoids are now known to produce the same change, though less actively. Their action is analogous to that of the ptyalin in the saliva of the higher animals. It is the presence of diastrase that

enables the brewer to use four parts of raw grain to one of malt in the process of mashing. [BREWING.]

Diathermancy, that quality of certain substances which renders them capable of transmitting heat-radiation without absorbing it. No substance is perfectly diathermanous or transparent to heat, just as no body is perfectly transparent to light. Glass allows of the passage of bright heat, as may be felt in a glass conservatory on a sunny day; but it is *athermanous* or opaque to dark heat, which renders it difficult for the heat that has entered the conservatory to pass out again. Rock-crystal is remarkably transparent for dark heat; this makes it a useful material for prisms and lenses that are employed to deviate and concentrate dark heat-rays. [HEAT.]

Diathesis (Gk. *disposition*) a term applied to a particular constitution of the body in which there is a liability to certain forms of disease. Thus the terms "gouty diathesis," "strumous diathesis" and the like. In the "hæmorrhagic diathesis" a tendency to bleeding exists. Thus as the result of a slight wound a considerable loss of blood may occur, profuse bleeding at the nose, too, is a common phenomenon. This curious condition is markedly hereditary and only shows itself as a rule in males, though the diathesis is transmitted as a rule through the mother, she herself remaining unaffected by the condition.

Diatoms, a numerous group of microscopic plants, sometimes classed among Algae (q.v.), but now ranked as an independent class of the Thallophyta (q.v.). They are unicellular, and have within their cell-wall a siliceous case composed of two halves or *valves*, one fitting over the other like the lid over a pill-box. They vary in size from less than one-third of a millimetre to three millimetres in length, the marine forms being the largest. In external form they are extremely varied, being round, oval, linear, fusiform, crescent-shaped, cuneate, or S-shaped (sigmoid); and their siliceous cases exhibit remarkably varied minute geometrical patterns as if of ornamentation, which have been used by microscopists to test the power of their lenses. Some diatoms occur on moist rocks, others in pools or streams on mud- or water-plants, and others in brackish or salt water on algae or in the stomachs of marine animals. Some are free, others loosely united in chains, and others attached by gelatinous threads to foreign bodies. Some species abound in the ice and deep waters of polar regions, whilst others occur in hot springs. Within their cells are plate-like chloroplastids; but the green colour is masked by a brown substance known as *diatomin*. Diatoms multiply rapidly by bipartition, each individual or *frustule* separating into two valves, each of which forms a new but slightly smaller half. After several such bipartitions, a larger cell or *auxospore* is formed, and then the process recommences. In some cases the auxospore results from a true process of conjugation, and is, therefore, a zygospore (q.v.). Vast deposits composed almost exclusively of diatoms have been found in many places, most being of Tertiary age. That

at Richmond, Virginia, is 40 feet thick, and extends for many miles. Under the names *tripoli*, *polishing powder*, *mountain meal*, *kiesel-guhr*, and *dynamite-earth*, they are extensively employed as a polishing material or as an absorbent for nitro-glycerine in the manufacture of dynamite (q.v.).

Diatonic Scale (Greek *dia tonon*, by tones), a scale which proceeds mainly by intervals of whole tones. The scale of C major has five whole tones and two half tones.

Diaz, BARTHOLOMEW (d. 1500), was a Portuguese navigator who, starting upon an exploring expedition with two vessels, sailed down the coast of Africa and anchored at Agradas das Voltas in 29° S. latitude. He sailed on south and doubled the Cape of Good Hope, and reached the bay of Lagoa on the east coast. It was his desire to sail on in search of Prester John's country, but his sailors, like those of Columbus, thwarted his wishes. He again doubled the Cape, to which he gave the name of Cabo Tormentoso on account of its storms, but this name was changed by King John II. of Portugal to that which it now bears. In 1500 Diaz commanded a vessel in Cabral's expedition, which resulted in the discovery of Brazil, if, indeed, it had not already been discovered, a point which is doubtful. On the way home Diaz was lost together with the vessel which he commanded.

Diaz del Castillo, BERNAL (d. 1560) accompanied Cortes to Mexico in 1519, taking a great part in the events that accompanied the conquest of that country, and eventually dying there. He wrote a history of the conquest, which was published at Madrid in 1632, and has proved of great value to subsequent chroniclers as being the work of an eyewitness of the deeds described.

Diaz de la Peña, NARCISO VIRGILIO (1809-1876), a French painter of Spanish descent, born at Bordeaux. He was of considerable though irregular talent, and excelled chiefly as a colourist. He was a good landscape painter, but committed the fault of putting his landscapes into the background, and filling the foreground with badly-drawn figures of nymphs and cupids and the like. Among his best known pictures are *Nymphs of Calypso* (1840), *Gypsies going to the Feast* (1844), and *Mare aux Vipères* (1857).

Diazo Compounds are a class of compounds which are characterised by the presence of two nitrogen atoms united to one another. The most important of the diazo-compounds are those of benzene derivatives and allied substances. The benzene diazo-compounds consist of the two nitrogens united on the one side to a benzene derivative and on the other to a monovalent radical—e.g. diazobenzene chloride is $C_6H_5.N:N.Cl$. These compounds are produced by the action of nitrous acid or a nitrite upon the salt of an amidobenzene derivative; thus from nitrate of aniline, $C_6H_5.NH_2.HNO_3 + HNO_2 = C_6H_5.N:N.NO_3$ (diazobenzene nitrate) + $2OH_2$. They are usually colourless, soluble crystalline bodies, but turn yellow or brown if exposed to the air. They are easily decomposed, and explode by concussion if heated.

They were discovered by Griess in 1859, and the discovery is one of the most fruitful and important of modern organic chemistry, as the compounds are invaluable in pure chemistry, since they furnish means of innumerable important synthetic and other reactions, and in applied chemistry, especially in the preparation of various dyes and coal-tar colours.

Dibdin, CHARLES, actor, musician, dramatist, and song-writer, was born at Southampton in 1745. He became musical leader at Covent Garden, and manager of the Sans Souci theatre; he wrote also numerous light pieces, and a *Complete History of the English Stage* (1795); but his fame lives almost entirely by his numerous nautical songs. Among the most celebrated of these are *Tom Bowling*, *The Jolly Young Waterman*, *Poor Jack*, etc. Dibdin, who in 1803 wrote an interesting account of his professional life, and whose biography was later written by his son, died on July 25, 1814. It has been said, with some truth, that during the long French wars the naval songs of Dibdin conducted more than anything else to the satisfactory manning of the fleet.

Dibdin, THOMAS FROGNAL (1776-1847), the nephew of Charles Dibdin, was an English bibliographer. Educated at Eton and Oxford, he adopted the law as a profession, and practised for a time. He then entered holy orders and became a popular preacher in London. He was for some time librarian to Lord Spencer. In 1812 he was elected first vice-president of the Roxburghe Club. Among his works were *Bibliomania*, *Bibliographical Decameron*, *Typographical Antiquities of Great Britain*, and *Reminiscences of a Literary Life* (published 1836).

Dibranchiata, the sub-class of Cephalopoda (q.v.) including all the living forms excepting the Nautilus. The name is given them because they all possess one pair of gills, whereas the Nautilus, and probably the others of the second sub-class, possess two pairs. The shell is very varied: it may be entirely external, as in the female Paper Nautilus (*Argonauta*), but is then not chambered; it may be chambered and only partly external as in *Spirula*, or chambered and wholly internal as in the Belemnites—in these latter the chambered portion is protected by a solid "guard"—or the shell may be a laminated plate, wholly internal, calcareous in the Cuttle Fish and horny in the Squids; finally, the shell may be absent as in the Devil Fish (*Octopus*). The animal has never more than ten arms, and in one group has only eight; these are always provided with suckers. The siphon is a closed funnel-shaped aperture; an ink sac is always present. The Dibranchiata are divided into two orders: the Decapoda (q.v.), including the Belemnites, *Spirula*, Cuttle Fish, Squids, etc., and the Octapoda (q.v.), including the Devil Fish, Paper Nautilus, etc. The class began in the Trias and has been since increasing in importance, while the Tetrabranchs have become almost extinct.

Dice (plural of *die*, Fr. *dé*, from Lat. *datum*, given). The invention of dice was ascribed by the Greeks to the Lydians, or to the Homeric hero

Palamedes: but they are found in very early Egyptian tombs, and are mentioned in the *Rig-Veda*. In Greece and Rome the small bones from the ankles of sheep and goats were used. Originally the game seems to have been one of skill, the bones being thrown up and caught. Later, the sides of the bones were marked with numbers, the rounded ends being left blank. The values of each throw were determined by special rules, and were not necessarily those of the numbers. Each throw had its own name. Stone dice were also used, and the rounded ends were sometimes squared and numbered. The game was often forbidden by law in Greece and Rome, and also in the Middle Ages, by St. Louis for instance. Playing dice for money has been illegal in England since the reign of George I.

Dicerus, a remarkable extinct genus of *Lamellibranch mollusca*, allied to the modern *Chama*. The two valves were almost equal, and the "umbo," or beak, is of great size in each valve, and is coiled as a loose spiral; hence, single valves resemble the shells of *Gastropoda*. The genus occurs in the Oolitic rocks of the Continent. A species of a closely allied genus occurs in the Lower Greensand of the South of England; it is known as *Itequientia lonsdalei*.

Dichlamydeous, a term of Greek origin applied to such flowering plants as have a perianth of two whorls of leaves—i.e. both calyx and corolla (q.v.)—and are also known as *complete*, in contradistinction to the *Incomplete*, which are either monochlamydeous, having one floral envelope, or aclammydeous, having none.

Dichotomy, dividing into two, especially applied to certain growing-points and other structures in plants in which such division occurs without the formation of buds. In the axial structures of the lower plants this often arises from the division of a large apical cell; in the leaf-structures of higher plants it originates in the division of a mass of smaller cells forming an apical *meristem* (q.v.). The term was formerly applied to such inflorescences as the cymes of the pink tribe, in which two lateral buds form one on either side of a terminal one, which are now termed *dichasia*.

Dichroism, in *Crystallography*, is that property of many crystals by which they appear of different colours when viewed in different directions. Certain fluids are also called dichroic when they are of different colours when viewed by transmitted or reflected light, or when the depth of the fluid is varied. These are more correctly known as *fluorescent*.

Dick, JAMES (1743-1828), a native of Morayshire, and afterwards a London merchant. In 1828 he left over £100,000 for the education of natives of Moray, Banff, and Aberdeen. The teachers employed under this system were appointed by examination, and payment to the schools was regulated by results, the average grant being £30.

Dick, ROBERT (1811-1866), a Scottish geologist

and botanist, who pursued his scientific studies while earning his livelihood as a tradesman of Thurso. Samuel Smiles published a life of him in 1878.

Dickens, CHARLES, was born at Landport, Portsmouth, February 7th, 1812. He was a son of John Dickens, then stationed in Portsmouth Dockyard as a clerk in the Navy Pay Office. In 1814 the elder Dickens was recalled to London, and two years later he went to Chatham, where the future novelist attended a school in Gibraltar Place. As a child he read deeply, and is even said to have attempted original writing. Owing to reforms in the Admiralty, John Dickens lost his post and most of his income in 1821. He moved with his family to London; and in the suburb of Camden Town Charles Dickens experienced that pinch of poverty to which frequent reference is made in his works. The father was soon arrested for debt, and Charles was placed in a blacking manufactory in Hungerford Market, where he was employed in putting labels on the blacking-bottles. The degradation of his surroundings made a deep and lasting impression upon his mind. When the father recovered his liberty, the boy was sent to a private school in the Hampstead Road. On leaving school he entered a solicitor's office, where he taught himself shorthand, and in his seventeenth year he became a reporter at Doctors' Commons. At this time he ardently longed to go upon the stage, but fortunately for the future of literature his desires remained unfulfilled. In 1831 he joined the reporting staff of the *True Sun*, and in 1834 he became a reporter for the *Morning Chronicle*. Dickens began his real career, however, in December, 1833, when he published in the *Old Monthly Magazine* his first original article, entitled "A Dinner at Poplar Walk." Other papers succeeded, and he made a profitable engagement with the conductors of the *Morning Chronicle* to supply a series of papers for the evening issue of that journal. These papers were reprinted in 1836 under the title of *Sketches by Boz*. A comic opera, *The Village Coquettes*, appeared the same year. The success of the *Sketches by Boz* led Dickens to undertake in 1837 the production of a serial, in monthly parts, entitled *The Posthumous Papers of the Pickwick Club*. The monthly numbers of this immortal work attained almost at once a phenomenal popularity, and that popularity has never since declined. *Oliver Twist* (which first appeared in *Bentley's Miscellany*, on which Dickens was for a time editor) was published in 1838. This powerful story lifted the veil upon life in the provincial workhouses and in the London slums. It was succeeded by *Nicholas Nickleby* (1839), one of the best as well as one of the most widely-appreciated of the novelist's works. In 1840 Dickens undertook a serial collection of stories, called *Master Humphrey's Clock*. *The Old Curiosity Shop* (1840), which contains for its central figure that exquisite and pathetic creation, "Little Nell"; and *Barnaby Rudge* (1841), a tale associated with the Lord George Gordon Riots, appeared in this series, together with a number of shorter stories and sketches. In 1842 Dickens visited the United States, and on his return published his *American Notes for General Circulation*, a work which gave great offence in the States

for its too caustic pictures of Transatlantic society. *Martin Chuzzlewit*, which appeared in 1843, also contained unflattering representations of American character. Though regarded as one of the most masterly of the author's works, it was received with less favour than its predecessors. It has since advanced largely in the public estimation, however, and several of its characters, including Mrs. Gamp and Mr. Pecksniff, are as famous as any the novelist has drawn. The "Christmas Books"—which included *The Christmas Carol*, *The Chimes*, *The Cricket on the Hearth*, *The Battle of Life*, *The Hallowed Man*, and *The Ghost's Bargain*—were issued at intervals from 1843 to 1848. In 1845-46 Dickens visited Italy, and the result of his travels appeared in a series of sketches, *Pictures from Italy*, which were published in the *Daily News*. Dickens was the editor of this new journal, but finding the work uncongenial, he relinquished it, and returned to his creative work in literature. What may be termed his second period in fiction began with the publication of *Dombey and Son*, in monthly numbers, in 1846-48. Then came *David Copperfield* (1849-50), which is usually regarded as one of the finest of his works. In great part it was a record of the novelist's own experiences, so that its humorous and pathetic revelations possess an autobiographic interest. Dickens established in 1850 a cheap weekly periodical, called *Household Words*, but this was superseded in 1859 by *All the Year Round*, which he conducted until his death. *Bleak House*, a novel depicting the abuses of the Court of Chancery, was published in 1852-53; and *The Child's History of England* and *Hard Times*, a tale dealing with questions affecting the working man, in 1854. *Little Dorrit*, which depicts the self-sacrificing devotion of a daughter for a worthless parent, appeared in 1855-57; and during its progress Dickens removed from London to Gad's Hill Place, near Rochester, where he ever afterwards resided. *A Tale of Two Cities*, which graphically describes the horrors of the French Revolution, was published in 1859. At this time, Dickens undertook his first series of public readings. Though extremely popular and profitable, the readings undoubtedly sapped his physical strength; and his intellectual productiveness from this period was not so great as in previous years. *Great Expectations* appeared in 1860-61; *The Uncommercial Traveller* in 1861; *Our Mutual Friend*, the last of his lengthy completed works, in 1864-5; while Christmas stories, mainly from his pen, appeared at the close of every year in *All the Year Round*. The novelist paid a second visit to the United States in 1867-8, and was received everywhere with the greatest enthusiasm. The success of his public readings was equal to that which he achieved in his native land. After his return to England he began the composition of *The Mystery of Edwin Drood*, which was destined to be the last of his works. The first numbers of the new serial were published in 1870, but the story remained unfinished at his death. In March, 1870, Dickens gave his last reading in St. James's Hall, the scene being a very memorable one. Medical advisers frequently warned the novelist that he was overtaxing his strength and energies, but his nature never permitted him to rest, and he literally died

in harness. On the 8th of June he was seized with a fit at his residence, Gad's Hill Place, and never recovered from the attack. He expired on the following morning, June 9th, 1870, in his fifty-ninth year. On the 14th of June he was interred in Poet's Corner, Westminster Abbey. The news of his death was received with profound and universal regret throughout the English-speaking world. Dickens married in 1838 a daughter of George Hogarth, the well-known musical critic and writer. For the encouragement of young authors the novelist was especially distinguished, and he was associated with Bulwer Lytton and others in founding the Guild of Literature and Art. He also took an active part in the administration of the Royal Literary Fund. Dickens was one of the greatest and most original of English novelists. Notwithstanding the tendency to caricature in his writings, the characters in his vast portrait gallery are, in the main, true to life. They are distinct types, creations as graphic as they are human. In the pages of this prince of storytellers comedy and tragedy jostle each other as they do in human existence, and he has equal command over the springs of laughter and of tears. Were there no other preservative qualities in his works, their intensity of feeling alone would ensure them the continuous appreciation of posterity.

Diclinous, imperfect or unisexual, a term applied to those plants in which the stamens or other male organs, and the carpels or other female organs, are either in separate flowers on the same plant (*monœcious*) or are on distinct plants (*diœcious*).

Dicotyledons, the larger, and, in most respects, the more highly organised class of angiosperms, or fruit-bearing flowering plants. In their embryos they have in almost all cases two cotyledons (q.v.), or seed-leaves, and a primary root or radicle which is commonly protruded in germination and develops into a tap-root. The fibro-vascular bundles in the stem are *open*, i.e. retain a layer of *cambium* (q.v.), or growing tissue, between their wood and their bast. The bundles form a ring of wedge-shaped masses round a central pith or *medulla*, from which there radiate bands of tissue between the bundles, known as *medullary rays*. Part of these rays, the *interfascicular cambium*, in conjunction with the cambium within the bundles, which is termed *fascicular*, forms a complete ring of this soft protoplasmic tissue round the stem, from which additions are made to the wood on the inside, and to the inner bark or bast on the outside. Thus the wood is in more or less distinct seasonal (generally annual) rings, and the whole "bark" (q.v.), both the inner or bast, which is fibrous, and the outer or *periderm*, which is often corky, is separable. The leaves often have a pair of *stipules* (q.v.) at their base, have commonly distinct stalks or *petioles*, are often compound or divided, have not seldom hairy surfaces, and have a complex *venation* or system of vascular bundles, branching into many degrees of fineness of the so-called veins and generally forming an irregular network, whence they are termed *reticulate*. The leaves of the perianth, or calyx and corolla, are commonly in whorls of five, or, in

reduced types, of fours or twos; the stamens, two, four, five, ten, or indefinite in number; and the carpels, one, two, five, or indefinite. If both calyx and corolla are present, they commonly differ in texture and colour, the outer whorl being green, leaf-like, and often hairy externally, the inner commonly delicate and coloured. In a fossil state dicotyledonous angiosperms are not certainly known below the middle of the Cretaceous system. The class is divided into the three sub-classes *Incompletæ*, *Gamopetalæ*, and *Polypetalæ*. The largest Natural orders among dicotyledons are the *Compositæ*, *Leguminosæ*, *Rubiaceæ*, *Euphorbiaceæ*, and *Labiata*. [MONOCOTYLEDONS.]

Dictator, in Roman history, a special magistrate instituted, usually for six months, by one of the consuls in accordance with a resolution of the Senate, whenever the situation seemed to demand the suspension of the constitutional checks on the supreme power, as at great military crises. The traditional account gives the first case as in 501 B.C. These dictators were technically appointed "to carry on affairs" (*rei gerundæ causæ*). The other magistrates continued in office meanwhile as their subordinates. A vice-dictator or "master of the horse" was always appointed with, and selected by, these dictators. Occasionally, however, when the consuls were absent, dictators were appointed to preside at elections or perform special acts which were beyond the legal competence of the inferior magistrates. No dictator existed between B.C. 202 and 82, but the consuls in the case of need were invested with dictatorial power. In 82, however, Sulla, quite irregularly, caused himself to be appointed dictator to reform the Constitution. Julius Caesar's similar appointment was also quite irregular. (A magistracy with the same name existed in many Italian towns in early times, and in the cities of Greece an "asymnetes" was often appointed during civil strife with power to reform the Constitution.) The office was formally abolished soon after Caesar's death. The title has often been adopted by revolutionary leaders, especially in S. America.

Dictys of Crete was the companion of Idomeneus at the siege of Troy. A MS., said to have been a translation from a work of his, a *History of the Trojan War*, was very popular in the Middle Ages. According to some it was written about 300 A.D., while others place it earlier; but there is no positive evidence as to its date.

Dicyemidæ, a family of Mesozoa, the supposed group of animals intervening between the Protozoa (or unicellular) and Metazoa (or multicellular animals). Each Dicyemid is composed of two parts, a head (or calotte) and a body. There is no differentiation of the cells into two layers separated by an intermediate mesogloa or mesoderm. There are, however, some germ cells in the large original interior or "endoderm" cell; these may represent the intervening layers. All the supposed Mesozoa are parasitic, and it is therefore most likely that they are degenerate Metazoa; the question is, however, a difficult one, and is at present unsettled. The Dicyemidæ are all parasitic on Cuttlefish.

Didactic Poetry (Greek *didasko*, I teach), poetry professing to convey instruction on some subject, as the *Georgics* of Virgil on agriculture, and usually also having a certain moral significance.

Didelphia, a subdivision of Mammalia, containing the Marsupials (q.v.).

Didelphys. [OPOSSUM.]

Diderot, DENIS (1713-1784), a French writer and philosopher born at Langres in Champagne. He was educated at a school of the Jesuits, and at the Parisian Collège de Harcourt. In 1745 he published an *Essai sur le Mérite et la Vertu*, and *Pensées Philosophiques* in 1746. This was more or less an attack upon Christianity, as were also *Lettres sur les Aveugles à l'usage de ceux qui voient*. In consequence of these writings he was imprisoned in Vincennes. He tried writing for the stage, but this was a failure. In 1749 he collaborated with D'Alembert to produce the *Encyclopædia*, for which he wrote upon art, mechanics, history, and philosophy, and revised the work generally. The work was a financial failure, but the Empress Catherine of Russia came to his aid, buying his library and giving him a pension. In 1773 he made a journey to St. Petersburg to thank the Czarina, and after his return to France he lived in retirement. Of his many works some were published after his death. A philosophic dialogue called *Le Neveu de Rameau* was translated by Goethe. He wrote an *Essai sur la Peinture*, *Paradoxe sur le Comédien*, and two tales, *La Religieuse* and *Jacques le Fataliste*.

Dido, or ELISSA, a daughter of Belus, king of Tyre. According to the legend, when her brother, Pygmalion, murdered her husband, Sicheus, for the sake of his wealth, Dido, with a party of Tyrians who sympathised with her, fled with a treasure, and founded Carthage about 800 B.C. She obtained a grant of land by a stratagem. She was promised as much land as a bull's hide would cover, and she cut the hide into fine strips and thus made it encompass a goodly amount of land. One account represents her as burning herself upon a funeral pyre to escape the necessity of marrying the king of the Gætulians. Virgil relates her adventure with Æneas and her suicide when he deserted her.

Didot, the name of a great printing, book-selling, and type-founding house of Paris. The founder of the house was François (1689-1757). François-Ambroise (1720-1804) invented new processes and machinery in type-founding. Pierre-François (1732-1795) was a noted bibliographer. Pierre (1761-1853) succeeded his father in the management of the business, and brought out a magnificent folio edition of the classics. Of these the best known are *Virgil* (1798) and *Racine* (1801). He also made many improvements in mechanical processes, and was an author. Firmin (1764-1836) was the brother of Pierre, and took charge of the type-founding department. Among other inventions he introduced a new script and improvements in stereotyping. Ambroise-Firmin

(1790-1876) and Hyacinthe-Firmin (1794-1880) were also members of the house, which is one of the most universal and most widely known institutions of Paris.

Didymium, a rare metal (at. wt. 143, sp. gr. 6.5), which occurs in certain rare minerals as cerite, gadolinite, and orthite. It was discovered by Mosander in 1842, but later work has shown that it probably consists of two closely allied metals.

Diefenbach, JOHANN FRIEDRICH (1792-1847), a German surgeon, born at Königsberg. After studying at Bonn, Paris, and Berlin, he settled at Berlin, where he soon obtained the reputation of a good operator. He was noted for his success in making artificial noses, eyelids, and the like, and for his cures of stammering, squinting, and other defects.

Diego Garcia, an island of the Indian Ocean, in lat. 7° S. and long. 72° to 73° E. It is 30 miles long, and its bay is a useful coaling station. Population 700. The isle is a dependency of Mauritius.

Dieguesños, a term applied by the Spanish missionaries to all the Indian tribes of the S. Diego district, south-west California. Here the chief groups are the Kizh, Netela, and Kechi, all of whom appear to be outlying branches of the great Shoshone [SNAKE] family.

Dielectric, in *Electricity*, is any medium that resists the passage of electric quantity. By so resisting, the medium is in a state of strain. It may be fractured if its thickness is sufficiently small or the stress sufficiently great. Dielectrics are important as insulators to localise electricity in definite regions or to localise its line of flow from place to place. Air, glass, ebonite, guttapercha, indiarubber, solid paraffin, and sulphur, are examples of good dielectrics. A vacuum also behaves well in that capacity. [INSULATION.]

Diepenbeck, ABRAHAM VAN (1607-1675), a Flemish painter, born at Bois-le-Duc. He appears to have begun as an engraver, and a plate of his, dated 1630, shows great power. In 1632 he was at Paris, and, with some fellow-pupils, took part in the pictures painted by Rubens in the Luxembourg Gallery. After travelling in Italy, he returned to Antwerp in 1635, and painted windows in the cathedral and in the Dominican church, and also for the church of St. Gudule at Brussels. In 1636 the Antwerp authorities gave him the freedom of the city, and he entered the studio of Rubens. Shortly after he was invited to England, where he painted several portraits, among them that of Charles I. In 1652 he returned to Flanders, and then devoted himself chiefly to the painting of religious subjects. Among his works, *S. Norbert giving the Blessing*, now at Deurne, near Antwerp, shows great wealth of colouring, as does a *Rape of Ganymede*. Berlin, Dresden, and Vienna possess paintings of his. He died head of the Antwerp Academy.

Dieppe, a French town in the department Seine-Inférieure, at the mouth of the river Arques,

93 miles N.N.W. of Paris. The name is possibly connected with the English *deep*, and once the town was the chief port of France. The revocation of the Edict of Nantes in 1685 did much to damage it, and the claims of the rival port of Havre gained the upper hand. Of its buildings, the thirteenth-century church of St. Jacques, built with stones brought from England; that of St. Rémi, built in 1522; and the old fifteenth-century castle, now barracks, are notable. On the west is the suburb La Barre, and on the opposite side of the harbour is the fishing quarter La Follet. The port admits vessels of 1,200 tons, but not at low water; and it is well known to English travellers as the point of communication with Paris by way of the Brighton and South Coast Railway and Newhaven. The town is well frequented as a watering-place and bathing-place; and the ivory manufactures of Dieppe have a great reputation. There are also saw-mills, horn and bone works, lace manufacture, and sugar-refineries, and much shipbuilding. There is also considerable fishing, and a good foreign trade. Quebec, in Canada, was founded by Dieppeois.

Diet. [FOOD.]

Diez, FRIEDRICH CHRISTIAN (1794-1876), a noted philologist of the Romance dialects, for which he has done much the same work as Grimm for the German dialects. He lectured at Bonn, and became a professor in 1830. His best-known works are *Poetry of the Troubadours*, a *Grammar of the Romance Languages* (1836-1842), and his *Etymological Dictionary* (1853).

Difference, of two numbers, is the result obtained by subtracting the smaller from the greater, and similarly for any two quantities of the same kind. The difference of two physical quantities is often of more importance than the actual value of either; the difference of height of two points, for example, or the difference of electric potential, being frequently required when the absolute height or absolute potential are not wanted. In pure mathematics the law regulating a series of numbers may be derived by obtaining the successive differences between first and second, second and third, and so on. Thus the series representing the squares of the natural numbers is

0, 1, 4, 9, 16, 25, ...

The successive differences are

1, 3, 5, 7, 9, ...

The differences of these again are

2, 2, 2, 2, 2, ...

and we thus come to a stop, for there is no more complexity in the series. In this way we may gauge the complexity of a series by the number of times that successive differences are to be taken. In the case of the cubes of the natural numbers we have

0 1 8 27 64 125 ...

First differences 1 7 19 37 61 ...

Second differences 6 12 18 24 ...

Third differences 6 6 6 ...

On these considerations is based a calculus of differences, by means of which the summation of

such series may be effected and other dependent problems solved. It is of considerable importance in statistical work, and in the approximate determination of areas, etc.

Differentiation, in *Mathematics*, is the process of finding the magnitude of the change in a definite quantity, that is brought about by a small change in another quantity upon which the first is dependent. These small changes are called *differentials*, the general study of which is undertaken by the differential and integral calculus. [CALCULUS.]

Diffugia, a genus of Rhizopoda (q.v.) belonging to the family *Arcellina* (q.v.), common in the stagnant water in ponds and ditches. It consists of a small amœboid mass enclosed in a shell or carapace composed of grains of sand cemented together by a membranous secretion. There is an aperture at one end of the cell, and through this the finger-like processes or "pseudopodia" are extruded. The animal is little more than an Amœba (q.v.) protected by a layer of sand grains, and with the pseudopodia restricted to a single area. *D. proteiformis* is a common English species.

Diffraction, in physical *Optics*, is that phenomenon exhibited by light-waves, of being deflected out of their rectilinear course when striking against the edges of obstacles. On account of the wave-lengths of light being extremely small, diffraction is not very pronounced; with waves of sound in air the analogous effects are much more marked, the sound-waves being much longer. Newton's great objection to the wave-theory of light was that light did not behave in the same way as other wave-motions, in travelling round corners, etc. Diffraction shows that it does behave in the same way, and that Newton's objection was therefore invalid. [LIGHT, WAVE-THEORY.]

Diffusion, in *Physics*, is that property possessed by the particles of liquids and gases, of travelling from place to place by reason of the energy with which they are endowed. In a boiler, where steam at a high temperature is enclosed in contact with water at the same temperature, the particles are endowed with sufficient energy to pass incessantly from any one part of the enclosure to any other, whether from the liquid to the gas or back to the liquid again. In a glass of water that is apparently motionless the particles are continually, though slowly, moving from place to place in the body of the liquid; and though opposed in part by the skin-like action of the surface of the water, they continually effect a passage into the surrounding air and probably an occasional return to the liquid. The fact that diffusion actually occurs is more readily shown by the use of two liquids of different colours. Graham poured a strong solution of bichromate of potash along the bottom of a glass cylinder half filled with water, so carefully as to avoid mixing the liquids. Though the lower had the greater density, it was found that the sharp line of separation of colourless water from the deep red potash salt solution gradually became indistinct, and traces of colour appeared higher and higher in the cylinder of water until uniformity

of tone and constitution was reached. This proved that particles of the heavier liquid had in opposition to gravity risen into the lighter medium above, and that the lighter water particles had similarly descended.

Digby, SIR KENELM (1603-1665) an English knight, was educated at Oxford, and when Charles I. became king, was appointed gentleman of the bedchamber, a governor of the Trinity House, and a commissioner of the navy. He fitted out an expedition against the Algerines, then became a Catholic, and from 1638-43 was in prison as a Royalist. He then retired to the Continent until the Restoration, when he returned to England and became a member of the Royal Society.

Digby, HON. ROBERT, British admiral, was born about the year 1733. In 1759 he participated in Hawke's glorious victory over M. de Conflans. In 1778 he shared in Keppel's action with d'Orvilliers, and in the following year was promoted to be rear-admiral. In 1779 he was appointed second in command of the fleet which, under Rodney, defeated De Langara off St. Vincent, and relieved Gibraltar. He subsequently held chief command in North America. He died in 1814.

Digestion. The food which is taken into the mouth consists of substances of varied composition, which are classified as follows: Proteids, fats, sugars, starches, mineral salts, and water.

Proteids are substances containing the elements carbon, oxygen, nitrogen, hydrogen, with a little phosphorus and sulphur. Most proteid substances are non-diffusible, i.e. they will not pass through animal membranes. (The particular group of proteids called peptones are, however, an exception to this rule.) The myosin of muscle, the albumin of white of egg, the gluten of bread, and the casein of cheese are examples of proteid substances.

Fats contain the elements carbon, hydrogen, and oxygen, the two last-named elements not being in the same proportions in which they are found in the case of water (H₂O). Fats, chemically considered, are compounds of glycerine with a fatty acid; they do not readily pass through animal membranes, but are convertible, under certain conditions, into soluble soaps, which do so readily.

The *sugars* and *starches* are often grouped together, and called carbohydrates. A carbohydrate is a substance containing carbon, hydrogen, and oxygen, the hydrogen and oxygen being present in the same proportions in which they are found in water. The sugars are diffusible substances, the starches are non-diffusible.

The structure of the wall of the alimentary canal presents certain peculiarities in different situations, but, generally speaking, the outer tunic or tunics are composed of unstriated muscle, while internal to these is the mucous membrane, and between the two is what is called the submucous coat.

On the internal aspect of the mucous membrane there is always found (from the œsophagus to the anus) a single layer of columnar epithelial [EPITHELIUM] cells. In the mucous membrane ramify innumerable capillaries, and diffusible substances

readily pass from the digestive tract into these capillaries. Moreover, the mucous membrane is beset with glands, the secretions of which pass into the alimentary canal and mix with the food contained therein.

The bulk of the food undergoes absorption in the alimentary canal—that is to say, it finds its way into the capillaries which ramify in the mucous membrane. Only about one-tenth of the dry solid matter ultimately remains unabsorbed. The process of absorption is facilitated by the conversion of the non-diffusible constituents of the food into diffusible substances, this conversion being brought about by the various digestive juices secreted by the glands and poured from them into the alimentary canal, where they mix with and act upon the food.

Thus, by the action of these secretions, or digestive juices, non-diffusible substances in the food are converted into diffusible substances. These diffusible substances find their way into the network of capillary blood-vessels which exists in all parts of the mucous membrane, and so into the portal system of blood-vessels, whence they are conveyed by the portal vein to the liver, and so reach the general circulation. The absorption of nutrient materials from the alimentary canal is not entirely a question of diffusion through an animal membrane—that is to say, it is not purely a physical process. To this matter, however, it will be necessary to return.

It will now be convenient to consider the various parts of the alimentary canal, to allude very briefly to their structural peculiarities, and to discuss the several changes in the food brought about by the secretions proper to each.

In the mouth the food undergoes the process of mastication; that is to say, the portions of food are broken up by the teeth and mixed with the secretions of the glands opening into the mouth until a “bolus,” or pulpy mass, is produced, which is passed backwards by the tongue into the grasp of the muscles of the pharynx, which contract upon it and force it downwards into the œsophagus.

The secretions of the mouth comprise the mucus yielded by the buccal glands and the several salivary secretions. The latter are produced by the salivary glands (q.v.), parotid, submaxillary, and sublingual, which are arranged in pairs, so that there are six salivary glands in all. These glands elaborate the saliva, and discharge it through their ducts into the mouth, where it is mixed with the food.

The saliva is a very watery secretion (994 parts of water in 1000 parts); it contains, however, a substance ptyalin, which possesses the property of converting starch into sugar. Only a small portion of the starchy elements of the food, however, are converted into sugar in the mouth.

The bolus of food passes down the œsophagus (q.v.), or gullet, and reaches the stomach (q.v.).

In the stomach two kinds of glands are present. The one kind (cardiac or peptic glands) is the more numerous, and is found throughout the whole mucous membrane of the stomach, excepting the portion near the pylorus. The other kind (pyloric glands) occurs in the neighbourhood of the pyloric orifice of the stomach. The food remains for some time (ten minutes to two hours or more) in the stomach,

and becomes thoroughly mixed with the secretion of the glands of the stomach, which is called gastric juice. The muscular walls of the stomach contract, and cause the contained food to be thrown into movement and to be broken up and dissolved in the gastric secretions. The pyloric orifice is closed by a band of muscular fibres which surround it—the sphincter of the pylorus, as it is called. From time to time this sphincter relaxes and allows the contents of the stomach to escape into the small intestine. The material which thus escapes is of the consistence of thin gruel, and is called *chyme*. The gastric juice is mainly derived from the cardiac or peptic glands. It is acid in reaction (the acidity being due to free hydrochloric acid), and contains a substance called pepsin. Pepsin possesses the property of converting non-diffusible proteids into diffusible peptones. The peptone formed partly diffuses through the mucous membrane of the stomach and reaches the capillary network of the gastric mucous membrane.

Thus of the different kinds of food stuffs the proteids are those which are chiefly acted upon in the stomach. Starchy foods are unaffected. Sugars may be to a certain extent absorbed. Fats are broken up, the particles of fat being reduced to a fine state of subdivision, but they are not made diffusible. To the result of this process of breaking up of fatty substances the term emulsion is applied, and the fats are said to be emulsified.

At the commencement of the small intestine two important secretions are mingled with the food, namely, the bile and the pancreatic juice. The bile (q.v.) is alkaline, and the further processes of digestion which occur throughout the small intestine are carried on in an alkaline and not as in the stomach in an acid medium.

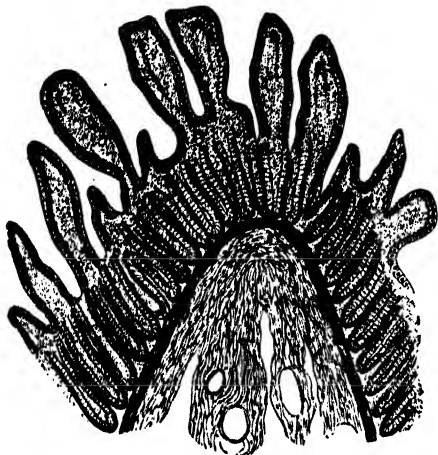
Moreover, the bile possesses the property of emulsifying fats.

The functions of the pancreatic juice are very important. In the first place it converts starches into sugars; secondly, it acts upon proteids, converting them into peptones (and more than this it decomposes further some of the peptone with the formation of bodies known as leucin and tyrosin); thirdly, it emulsifies and saponifies fats. The pancreatic juice thus acts upon the three kinds of non-diffusible food stuffs (viz. proteids, starches, and fats), converts them into diffusible material, and so facilitates their absorption.

The structure of the small intestine may be briefly alluded to; the mucous membrane is thrown into folds called *valvula conniventes*; these folds secure the thorough admixture of the secretions with the liquid intestinal contents, and, moreover, offer a largely increased extent of mucous surface for secretion and absorption. The glands of the small intestine are of three kinds—Brunner's glands in the duodenum, the crypts of Lieberkuhn, which occur throughout both large and small intestines, and the lymphoid glands. Little is known concerning the secretion of the two former kinds of glands. The lymphoid structures either occur singly (*glandula solitaria*) or in patches (*glandula agminata*). The latter are also called Peyer's

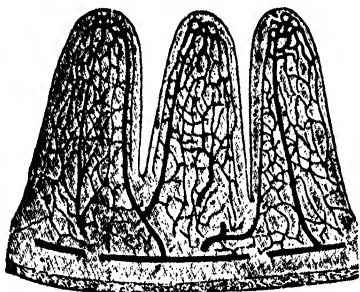
patches ; they are limited to the lower six feet of the small intestine.

A remarkable and characteristic element of structure in the small intestine is the *villus*. Each villus is a projection of mucous membrane $\frac{1}{60}$ inch or thereabouts in length, containing capillaries, unstriated muscular fibres, adenoid tissue, and a central lymph channel or lacteal. The villi being closely set, give a velvety appearance to the surface of the intestinal mucous membrane as seen



MUCOUS MEMBRANE OF THE SMALL INTESTINE OF THE DOG.
(Showing villi and glands.)

with the naked eye. The figure shows the appearance presented by a thin section through the small intestine of a dog when viewed under a magnifying power of some 60 diameters, the projections being the villi. The richness of the blood supply to these villi is seen in the adjoining figure, which shows



VILLI OF THE SMALL INTESTINE OF THE MOUSE.
(The blood-vessels are artificially injected.)

the appearance presented by a similar section through the small intestine of the mouse, in which the capillaries have been filled with injection material, in order to make their presence and arrangement obvious. The central lacteal (not shown in either figure) serves for the conveyance

of fatty matter. Each central lacteal is, in fact, in direct communication by a system of lymph channels with the thoracic duct, and this duct receives the contents of the several lacteals, and passing upwards in front of the vertebral column through the abdomen and thorax, ultimately empties itself into the junction of two large veins in the neck. The material which thus finds its way from the villus through the lacteal into the thoracic duct, and which finally is discharged into the veins of the neck and so reaches the general circulation, is called chyle.

Chyle is a milky fluid which contains fat in a finely divided state. The exact way in which these fatty particles find their way into the lacteal is not known. The villus, like all the rest of the mucous membrane of the small intestine, is lined by columnar epithelium, and hence the particles of the chyle, in order to reach the central lymph vessel of the villus, must somehow pass this wall of epithelium.

From what has been said it will be seen that the elements of the food which pass into the blood and serve for the nutrition of the body pursue one of two courses. Either they are taken up directly by the capillaries of the portal system and conveyed by the portal vein to the liver, after passing through which they reach the general circulation ; or they are taken up by the lacteals and conveyed by the thoracic duct into the venous system and so reach the general circulation. Diffusible peptones, sugars, and saponified fats pursue the former course, while the main constituents which enter the lacteals are, as already stated, fats which have been reduced to a fine state of subdivision.

The intestinal contents during their passage through the large intestine do not undergo changes of importance comparable to those which occur in the small intestine. In fact the main alteration is the acquirement of a semi-solid consistency.

All the assimilable substances having been taken up by the processes of absorption, the waste or non-utilisable elements of the food leave the body as *fæces*.

Digit (Lat. *digitus*, the finger), any number under ten ; in astronomy, one-twelfth of the diameter of a disc, *e.g.* of the earth or the moon.

Digitalin, the physiologically active constituent of the foxglove—*Digitalis*. Various investigators, employing different methods, have obtained compounds from the foxglove leaves or seeds, possessing a bitter taste and poisonous properties. These various compounds, all of which have been called *digitalin*, are probably compounds of the essential active principle, which has not been prepared pure, with different substances.

Digitalis. The official preparations of this important drug are an infusion (dose 1 to 4 fluid drachms) and a tincture (dose 5 to 30 minims). *Digitalis* is of very great service in certain forms of heart-disease ; it is also employed to increase the amount of the urinary secretion, and is said to be of value in checking hæmorrhage. [FOXGLOVE.]

Digitigrada. [CARNIVORA.]

Dijon, a town in eastern France, formerly the capital of Burgundy, now the *chef lieu* of the Côte d'Or department, is situated on a fruitful plain which is bordered by slopes covered with vineyards. The old ramparts have been converted into boulevards, and the town is protected by a chain of outlying forts. The town is at the junction of the Ouche and the Suzon, and is also on the Burgundy Canal. The view of the city from the neighbourhood is picturesque, and it seems to bristle with spires of every style and date. Many of the buildings date from the time at which Dijon was the Burgundian capital. The cathedral is large, and has a wooden spire of 300 feet in height. The churches of Notre Dame and of St. Michael are notable, as is the old palace of the Dukes of Burgundy, now used as town-hall and museum. The Palais de Justice was formerly the seat of the Burgundian parliament. There is a fine and interesting museum, and the town has good schools and colleges. There is a large wine trade, especially in Burgundies, and there are manufactures of woollen, hosiery, paper-hangings, candles, mustard, chemicals, machinery, as well as cotton and oil mills, foundries, and tanneries. Marcus Aurelius is said to have established here a *Castrum Divionense*, and Dijon has played an important part in later history. It came into the possession of France upon the death of Charles the Bold in 1477, and it was the scene of fighting in the Franco-German war both in 1870 and 1871. Charles the Bold and Bossuet were born at Dijon.

Dilapidations, want of repairs required to a house during the tenancy or at its expiration. The word has also a special significance in ecclesiastical law. The incumbent of a benefice is bound to keep the parsonage house and chancel of the church in good and substantial repair, restoring and rebuilding where necessary according to the original form, and where he neglects these duties, or commits waste on the timber or lands of the benefice, he is liable to be punished in the Ecclesiastical Court and to be compelled to restore the premises to a proper condition. He is also personally liable to an action at law by his successor in the benefice. By a statute passed in the reign of Victoria (19 and 20 Vic., c. 50) it is provided as to advowsons vested in (or in trustees for) inhabitants or other persons forming a numerous class and deriving no pecuniary advantage therefrom, that the same may be sold by order of such persons, and the proceeds applied to the beneficial purposes therein specified, and which include the erection of a parsonage house if there be none, or the rebuilding, repair, or improvement of any parsonage house then already existing.

Dilem, a large and powerful branch of the Arab bedouins, on the east bank of the Euphrates, in the province of Baghdad, coterminous southwards with the Beni Laam bedouins, and ranging eastwards as far as the Persian frontier; twelve main branches—Al Mahamdeh, Al Duweb, Abu Shab, Kistan, Abu Aaded, Abu Alwan, Al Janabin, Abu Rakebah, Abu Faraj, Abu Diyab, Abu Assaf, and Abu Nimr; there are over 20,000 tents, and about 10,000 fighting men.

Dilettante (Ital. from Lat. *delectare*, to delight), a patron of art, an amateur: often used in a half-contemptuous sense. The "Society of Dilettanti," however, which was founded in 1734 to promote the taste for ancient classical art in England, has done excellent service by facilitating exploration and by the publication of drawings of relics of ancient Greek art.

Dilfan, a large section of the Kurds of Luristan, West Persia, appear to be the true aborigines of this region, and are regarded as such by the rest of the population, who call them Leks or Laks, and who look upon themselves as more recent immigrants from the north-west. The Dulfans, who are certainly of Kurdish stock and speech, still maintain the tribal organisation, and, like the neighbouring Bakhtiari, are divided into a large number of clans. Chief divisions—*Mumwend*, with twelve branches, including the Bijâvend, Bavâli, and Hindi (gypsies); *Kâkârend*, with five branches; *Ivotirend*, with ten branches; *Aincvend* or *Cherâri*, with four branches (A. H. Schindler, *Reisen im Süd-westlichen Persien*, 1877-78). The tribal ending *rend* has been identified by Rawlinson with the Cuneiform *manda*, a dialectic variety of *mada*, whence *mede*, and the Dulfans seem to be direct descendants of the ancient Medes, of whom the Kurds (the Karduchi of Xenophon) were a main division.

Dilke, CHARLES WENTWORTH (1789-1864), an English journalist and critic, born in London. He was educated at Cambridge, and employed in the Civil Service. From 1830 to 1846 he was proprietor and editor of the *Athenæum*, and in the latter year he established the *Daily News*, which he edited for three years. Among his works were six volumes of *Old English Plays*, and many of his papers have been edited, together with a biographical sketch, by Sir Charles Dilke, grandson of the author.

Dilke, SIR CHARLES WENTWORTH (1810-1869), son of the above, was born in London, and educated at Westminster and Trinity Hall, Cambridge. He took an active part in the promotion of the Great Exhibition of 1851, as also in that of 1862, for his services to which he was created baronet. In 1865 he represented Wallingford in Parliament; he died in 1869 at St. Petersburg, whither he had gone as English representative at an agricultural exhibition.

Dilke, SIR CHARLES WENTWORTH, born 1843, is the son of the last-mentioned. After studying at Trinity Hall, Cambridge, he was called to the bar, and then travelled through the United States and the chief British colonies, embodying his experiences in his work *Greater Britain* (1868). In the same year he entered Parliament as an advanced Liberal, and held office twice. In 1886 he was defeated at Chelsea, and shortly afterwards retired into private life, but returned to Parliament at the election of 1892. He is a very high authority on Colonial and European politics, and military matters. His second wife was the widow of Mark Pattison. She died in 1904.

Dill. Dill water is a remedy which has a considerable reputation in the treatment of digestive disturbances in young children.

Dill (*Anethum graveolens*), an umbelliferous plant, native to Africa and Southern Europe, but cultivated to a small extent in dry soil and sheltered spots in England. It resembles fennel, having decomposed leaves, no involucre, yellow flowers, and oval fruits. These last yield dill-water and oil of dill, and are used in gin-distilling.

Dillmann, CHRISTIAN FRIEDRICH AUGUST, a great German Orientalist, born at Illingen, a village of Wurtemberg, in 1823. After studying at Tubingen under the celebrated Ewald, and after travelling in England and France, he occupied chairs of Oriental languages successively at Tubingen and Kiel, and in 1864 became professor of Old Testament exegesis at Giessen. He is a great authority on Ethiopic, a language that had been much neglected, and which he considers the fourth in importance among the Semitic dialects. He has written many works.

Dillon, JOHN, an Irish patriot and parliamentary representative, born in New York in 1851. His father was a prominent member of the Young Ireland party, and was M.P. for Tipperary at the time of his death. The son was educated at Dublin, and sat as Nationalist member for Tipperary 1880-1883, and later as member for East Mayo. He was leader of the Anti-Parnellite party for a time. His participation in the "Plan of Campaign" has cost him four imprisonments.

Diluvium, an almost obsolete term in geology, formerly applied to the boulder-clays (q.v.) and other deposits which are now known to be more or less directly due to the action of the ice of the Glacial Period (q.v.), because their usually unstratified condition suggested that they were the relics of a deluge.

Dimensions, in *Geometry* and *Physical Science*, relate to the degree in which fundamental units are involved in the formation of derived units. In pure geometry, for instance, the chief entities involved are points, lines, areas, and volumes. A standard unit of length exists from which are derived units of area and volume; thus starting with a length of one inch we derive the square inch for areas and the cubic inch for volumes. Whence we say that the dimensions of volume, *so derived*, involve the cube of a length, or that a volume has three dimensions. It is incorrect to speak of space as tridimensional. Concerning the much discussed question as to the existence of a fourth dimension in space, little need be said; its interest is at present purely speculative, and it can only be demonstrated that geometrical entities of four dimensions are not impossible. It may here be pointed out that the extremities of a line are points, which have no dimensions; the extremities of an area are lines, of one dimension; and that of a volume the extremities are areas, of two dimensions. A four-dimensioned figure should apparently be bounded by a three-dimensioned

figure, *i.e.* by a volume. In the theory of dimensions as applied to physics a great deal remains to be investigated. As an example of a derived unit we may take that of speed. We obtain the speed of a body by dividing the length traversed by the time taken to do so. Thus speed is of the nature of length divided by time; its dimensions are then $L \div T$. Certain measurable quantities may be differently defined and may have different dimensions according to the definition. Thus a quantity of water may be expressed by its volume or by its mass; these two are totally different, but a relation exists between the two expressions for the same physical quantity. This is of special importance in the case of electrical resistance, which has been defined in two ways. If any special resistance is estimated in terms of the two different units so obtained, a physical constant is found to exist in the ratio between the two numbers. That this constant is closely identical with the speed of propagation of light is the basis of Clerk Maxwell's electro-magnetic theory of light.

Dimorphism. 1. Certain minerals and chemical substances possess the property of crystallising in two or more distinct forms. When two forms occur the substance is said to be *dimorphous*, and the phenomenon is known as *dimorphism*; in the case of three forms, it is *trimorphous*, or the general term, *pleomorphous*, may be applied. Thus sulphur crystallises in either rhombic crystals or monoclinic (crystallography); it is hence dimorphous. Calcium carbonate is also dimorphous, existing both as *calcite* and *aragonite*. The oxide of titanium is an example of a trimorphous body, occurring in the three forms known as *rutile*, *anatase*, and *brookite*.

2. Different individuals of the same species often present very dissimilar form and structure. This is known as dimorphism, a phenomenon of which there are three main varieties, *viz.* seasonal, sexual, and functional. Seasonal dimorphism is best shown in regions which have a much greater difference between the summer and winter climates than in our temperate country: good illustrations are afforded by the annual change in colour of many northern animals, such as the Arctic fox, the Scandinavian grouse, etc., which are brown in summer and white in winter. Sexual dimorphism is more frequent; the differences between the peacock and the peahen, the lion and the lioness, the horned ram and hornless ewe, the occurrence of antlers among deer and reindeer only in the male, etc., are all cases of this variety. The differences between the two dimorphic forms in these cases are, however, insignificant when compared with those which occur among invertebrates; perhaps the most striking of these are met with among the Cirripedia (q.v.), where the male is a dwarfed form, very imperfectly developed, and which lives only to fertilise the female. A very familiar case among Invertebrates is that of the Bees (q.v.), where there are two kinds of females—the barren workers and the fertile queen bees. Functional metamorphism is probably the most important; it occurs mainly among colonial animals. The Bryozoa afford good illustrations

both of colonial and individual dimorphism; in the former it may be due directly to the action of the environment on the growing colony. Thus one species of Bryozoa may occur in the "Lepralian" form, as a mere crust over shells or stems; or it may rise into foliaceous frond-like expansions in the "Escharine" form, or it may form cylindrical branching shoots in the "Vincularian" form. In addition to this the individual zooids of the colony may exhibit functional dimorphism. Thus some zooids may be modified into the prehensile organs known as "avicularia," others into locomotor organs as vibracula, others into ovicells (marsupial pouches), and others into stems or root fibres. In cases where there are so many modifications, the phenomenon is generally referred to as "polymorphism." Another good illustration of this is afforded by the Siphonophora (q.v.) where the float or pneumatophore, the protective bracts or hydrophyllia, the rectocalyces, etc., are all dimorphic, or rather polymorphic, forms of one type of polypite. [HETEROSTYLY.]

Dimyaria, the group of Lamellibranchs including all those bivalve shells the valves of which are closed by a pair of muscles. It includes the two orders Isomya (q.v.) and Heteromya (q.v.); in the former the two muscles are approximately equal, as in the Venus shells, the Arcas, etc.; in the latter, the anterior adductor is much the smaller, as in the mussels.

Dinajpur, a Hindustani town of Bengal, 205 miles N. of Calcutta, and capital of a district of the same name. The district is about 4,118 square miles in extent.

Dinan, a French town in the department Côtes-du-Nord (Brittany), on the Rance, 14 miles S. of St. Malo, is prettily situated on a steep hill, 200 feet above the river, and is surrounded by old walls, now mostly ruined. Some of the monuments of Dinan are historically interesting, among them being St. Saviour's church, which contains the heart of Bertrand du Guesclin, the fourteenth-century castle of the Dukes of Brittany—now used as a prison—with the tower of Queen Anne, with its chapel containing Duchess Anne's easy chair. A saline hot spring, and the chateau of La Garaye, celebrated by Mrs. Norton, are in the neighbourhood.

Dinant, a Belgian town in the province of Namur, and 14 miles S. of it, on the Meuse, its situation having that picturesqueness which is characteristic of the riverside towns of the Belgian Ardennes. The place is important in the new scheme of frontier defence, and has borne its share in the wars of the past. The town is noted for its gingerbread (gâteau de Dinant). The town hall was once the palace of the Princes of Liège.

Dinapore, a town in Hindustan in the Patna district of Bengal, on the right bank of the Ganges, and about 12 miles N.W. of Patna. The town is the headquarters of a military district, and there are large barracks and cantonments.

Dindigal, an Indian town in the Madura district of the Madras Presidency, having a fort upon a height. The town is pleasantly situated at the end of a fertile valley.

Dindorf, WILHELM (1802-1883), an eminent German classical scholar. He was born at Leipzig; there he spent the greater part of his life, which he devoted almost entirely to Greek literature, and there he died. His chief works were editions of the Greek dramatists and comments upon them and other writers. His brother Ludwig shared some of his work.

Dingo (*Canis dingo*), the Australian wild dog, probably introduced before the discovery of the island by Europeans. It is a handsome animal, about the size of a shepherd's dog, with tawny fur, a flat, elongated head, and bushy fox-like tail. Their temper is fierce, but when taken young they can be tamed, and have been domesticated by the natives. They prey on sheep, and, though their numbers have been greatly reduced in South Australia, a reward of five shillings is still paid for killing a wild dog.

Dinoceras, the type genus of an extinct sub-order of huge herbivorous Ungulata (q.v.) discovered in 1870 in Eocene rocks in Wyoming by Professor O. C. Marsh. Seven species have been described. They had five toes on each foot; the femur and tibia in a straight line, as in the elephant; somewhat elongated nasal bones, but apparently no proboscis; three pairs of rounded horn-cores, which probably had horny sheaths; the upper canines prolonged into powerful tusks, the points of which rest against an expanded margin of the lower jawbone; and a remarkably diminutive brain-cavity. They equalled the elephant in size.

Dino flagellata, a subclass of the Mastigophora (q.v.), a class of the Protozoa. In this group the animal is provided with two or more flagella, of which both may be at the anterior pole as in the order Adinida, or one may occur at the pole while the rest are lodged in lateral furrows, as in the order Dinifera. The whole of the animals in this subclass are microscopic in size.

Dinornis, a genus of gigantic ostrich-like birds, related to the little wingless kiwi or *Apteryx* of New Zealand, but reaching a height of 10 or 11 feet. The egg of one kind is 10 inches long. Some 20 species occur in Pleistocene deposits and caves in New Zealand, where they are known to the Maoris, by whom they were probably exterminated, as Moas. Skin and feathers have been found, and remains of the genus have also been discovered in Queensland.

Dinosauria, an extinct order or sub-class of reptiles, only known at present from Secondary rocks. They are very varied in size and form, some terrestrial, others aquatic or amphibious; some carnivorous, but the majority herbivorous. The vertebrae are flat or slightly concave, those of the neck numerous. The hind limbs are longer and larger, and with the bones of the pelvis present

striking resemblances to those of the ostrich-like birds. Some genera at least walked erect, their powerful tails assisting in balancing their bodies. Some have dermal bony plates or *scutes*, which are even in some cases prolonged into formidable spines, and others have spur-like processes on the fore-feet. The limb-bones are in some cases solid, in others hollow; and the teeth are serrated, pointed and recurved in the carnivorous, and worn flat in the herbivorous kinds. Some forms seem to have been furnished with horny beaks. Some of the three-toed footprints in the Triassic rocks of America belong to Dinosaurs; but the group apparently culminated in the Jurassic. From rocks of this age in Colorado, Marsh obtained *Atlantosaurus*, the thigh-bone of which is over 6 feet long, so that the whole animal is estimated to have been 80 feet long and 30 feet high, the largest land-animal known in any age. Marsh considers that the dinosaurs should rank as a sub-class, and divides them into orders, of which the chief are the *Sauropoda*, *Megosauria*, *Ornithopoda*, and *Theropoda*. The *Sauropoda* are herbivorous with nearly equal limbs, solid limb-bones, and five claws on each of the plantigrade feet. This order includes the least specialised and most crocodilian forms, such as *Atlantosaurus* and *Brontosaurus*, as well as the huge British forms known as *Cetiosaurus*. The *Megosauria* differ in having very small fore limbs and osseous dermal armour, often spinous, as in *Scelidosaurus* from the Lias of Lyme Regis, *Polacanthus* and *Hylcosaurus* from the Wealden, and *Acanthopholis* from the Chalk. The *Ornithopoda* have small fore limbs with five digits each, hollow hind limb-bones, with only three or four toes to each digitigrade foot, and no teeth in the front of the jaw. This order includes the small arboreal or rock-climbing *Hypsilophodon* and the probably amphibious *Iguanodon* (q.v.). The *Theropoda* have small fore limbs, hollow limb-bones, digitigrade feet with prehensile claws and teeth indicating their carnivorous character. *Megalosaurus* and the Triassic *Thecodontosaurus* are among the best known European genera.

Dinotherium, a gigantic fossil proboscidean found in the Miocene beds of Hesse Darmstadt, France, Greece, and India. Its skull, measuring 4½ feet in length and 3 feet in breadth, indicates an animal larger than the elephant. It has ten molar teeth in each jaw, and the lower jaw is bent downwards anteriorly and has two huge tusk-like incisors bent downward and backward.

Diocese (Greek *dioikēsis*, arrangement), originally a subdivision of a Roman province, e.g. of Cilicia under Cicero's government. The Roman empire, in its administrative reorganisation by Constantine, was divided into four large districts, called *dioikēseis*, which were subdivided into provinces. The ecclesiastical divisions followed the civil, each of these districts being under a patriarch, and the provinces under bishops. Later, but not before the fourth century, the word was transferred to single bishoprics. In England, also, the ecclesiastical divisions followed the civil originally, the Anglo-Saxon bishoprics being originally coincident with

the several kingdoms. At present the dioceses are grouped in provinces, each under an archbishop (who also have special districts in which they perform ordinary episcopal functions), and subdivided into archdeaconries and parishes, which latter are grouped into rural deaneries. In the larger English dioceses the bishop is usually assisted by a suffragan. [BISHOP.] In the United States, each State was formerly a diocese of the Protestant Episcopal Church, but several have been subdivided. *Diocesan Conferences*, composed of clerical and lay members, have been held in most English dioceses annually since about 1850.

Diocletian, C. VALERIUS DIOCLETIANUS (45-313), a Roman, who, though of insignificant birth and a native of Dalmatia, was declared emperor by the army in 284 A.D. He fought in Mœsia, and conquered the Allemanni, and was a general favourite. He took to share the government with him M. Aurelius Valerius Maximus, and, later, C. Galerius and Constantine Chlorus. Of the four parts of the empire as thus divided Diocletian ruled Thrace, Egypt, Syria, and Asia. The great feature of his reign was the restoration of the power of the empire, which had been on the wane. Ecclesiastically, he is known as having sanctioned one of the persecutions of the Christians. In 305 he resigned his dignity, retired to Dalmatia, and dug his garden in peace. [SPALATO.]

Diodati, GIOVANNI (1576-1649), was born at Lucca of a noble Catholic family. He was professor of Hebrew and of theology at Geneva, and was a great friend of Milton, represented Geneva at the Synod of Dort, helped to draw up the Belgic confession of faith, and, with a view to advancing Reformation principles into Italy, made an Italian translation of the Bible. He died at Geneva.

Diodon. [GLOBE-FISH.]

Diodorus, called Siculus, because a native of Sicily, a historian of the time of Julius Cæsar and of Augustus. Having formed the project of writing a universal history, he devoted thirty years to the purpose, and travelled widely in Asia and Europe. His work was a history of the world from the beginning to the Gallic wars of Julius Cæsar. It was divided into three periods and 40 books, but of these books only 1-5 and 11-20, with some fragments, have survived.

Diocious, from the Greek *oikos*, a house, is the term applied to plants in which the two sexes are on distinct individuals. In many species of the wracks (*Fucus*) the antheridia and oogonia are on separate plants. Among mosses, plants are frequently exclusively male or female, as are the prothallia of most horsetails and some ferns. The heterosporous Pteridophyta bear two kinds of spores, macrospores producing prothallia which bear archegonia, and microspores producing prothallia which bear antheridia. In some flowering plants, such as willows and poplars, and the *Aucuba*, the carpels, or leaves bearing the ovules (macrosporangia) or female structures, are on distinct plants

from the stamens, or leaves bearing the pollen-sacs or microspores, the male structures.

Diogenes, commonly called the Cynic (412-323 B.C.), was a native of Sinope, in Pontus. His father was banished for coining, and the son accompanied him, going to Athens, where he was attracted by the fame of Antisthenes, and wished to become his disciple, and not even blows could deter him from his desire. From being an epicure and a sybarite, he advanced to the extreme of asceticism, but his tact enabled him to retain his influence over the Athenians. His principle seems to have been that the practice of self-government leads to every other good, but with him this self-government entailed contempt for everything that may distract the mind from the practice, including art and literature. On a voyage to Ægina he was taken prisoner by pirates and sold into slavery, and was bought by a Corinthian named Xenias, who, won by his character, set him free, and made him tutor to his children. It was at this time, if ever, that his celebrated interview with Alexander the Great took place, having for result that Alexander said if he were not Alexander he would be Diogenes. Of the different stories told about him—for instance, his living in a tub—they may or may not be true: probably not, though Landseer leads us to believe that the tub-life was contemporary with the Alexander episode. Shakspeare seems to have embodied the popular idea of Diogenes in Apemantus.

Diogenes Laertius, the Greek author of a history of philosophy, was born at Laerte, in Cilicia, whence his name. Little is known about him personally, but it is probable that he lived about the second century A.D. His work is interesting as throwing light upon Greek life, and as preserving fragments of other writers which would have otherwise been lost. Many later writers of lives of the philosophers have drawn upon his stores.

Diomedes. 1. The son of Tydeus and king of Argos, was one of the suitors of Helen, and thus bound to take part in the expedition against Troy, of which he was one of the principal heroes. The protection of Pallas and his own bravery caused him to play a conspicuous part in the struggle, wounding Aphrodite and Ares and attacking Apollo, and finally being one of the inhabitants of the wooden horse. 2. A king of the Bistones, who fed his horses on human flesh, and was killed by Hercules, who carried off the horses.

Dion of Syracuse was married to the daughter of Tyrant Dionysius the Elder, and had great influence over both the older and the younger Tyrant. He tried to reform the latter, and, being banished by his fellow-townsmen, he returned and made himself ruler of the city. In 353 he was assassinated.

Dion Cassius, a Greek historian, who has been described as the last of the old historians who knew the laws of historic writing, was born at Nicea 155 A.D., and was by the mother's side a descendant of Dion Chrysostomus (q.v.). His father was a Roman senator in the reign of Commodus, and the son became a senator and a

prætor under Pertinax, and was appointed governor of Pergamos and Smyrna. He also commanded in Africa and in Pannonia, where he overcame a sedition of the Prætorians. Having fears for his life during the reign of Alexander Severus, with whom he was at first in favour, he obtained permission to retire to his native place, and here he composed a history of Rome from the time of Æneas to his own. Of the 80 books of which this consisted, 19 (36-54) remain, together with some fragments, and a later abridgment gives some idea of the rest. His style was pure, and his speeches at times recall those of Thucydides, but his history contains errors, and he showed credulity as well as injustice towards some of the great men of Rome.

Dion Chrysostomus (50-110), a Greek sophist and rhetorician, born in Bithynia. He studied eloquence and philosophy, and travelled to get a knowledge of men. He was free-spoken and stoical. In answer to Vespasian, who consulted him in Syria, he advised the restoration of the republic. To escape proscription under Domitian he went into voluntary exile and worked as a labourer, having for companions a dialogue of Plato and a speech of Demosthenes. At Domitian's death he was at a camp on the Danube, and harangued the soldiers in favour of Nerva, who in return advanced him. He was an intimate adviser of Trajan, and gained many privileges for his fellow-countrymen, who, however, treated him with ingratitude. His orations, 80 in number, are in good Attic Greek. There are four discourses upon royalty, in which he takes occasion to extol Trajan.

Dionæa muscipula (VENUS'S FLY-TRAP), the only known species of the genus, a plant belonging to the Droseraceæ or Sundew family, native to the swampy ground round Wilmington in Carolina, but now commonly grown in greenhouses on account of its great physiological interest. It has few root-fibres and a scape terminating in a cluster of white flowers, but its important structures are its leaves. These form a radical rosette, not large individually, and pale green in colour. They have winged petioles or adnate stipules and round blades with strong mid-ribs. Round the margin of the leaf are inflexed spinous "tentacles," like the teeth of a gin, and on the upper surface of each half of the leaf are numerous glands and three or four long multicellular hairs. On these hairs being touched by an insect or other nitrogenous body, the normal electric current in the leaf is reversed, as was demonstrated with the galvanometer by Professor Burdon Sanderson, and the two halves of the leaf instantly shut together, the mid-rib acting as hinge. The glands then pour out a copious acid digestive secretion, and the leaf remains tightly closed until the food captured is digested and absorbed.

Dionysius, St., THE AREOPAGITE (Acts xvii. 34), according to tradition was one of the judges of St. Paul, when he appeared before the Areopagus. He was the first Bishop of Athens, and suffered martyrdom. The four treatises on *Celestial Hierarchy*, *Ecclesiastical Hierarchy*, *Divine Names*, *Mystic Theology*, ascribed to him, are probably

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spurious and later in origin. He is sometimes confounded with the St. Denys who became the patron saint of France.

Dionysius the Elder (430-367 B.C.), Tyrant of Syracuse, was of obscure parentage, but became a general and commander-in-chief of the army. Owing to his influence with the army, he made himself head of the state at the age of 25. He extended the rule of the city over the other cities of Sicily, fought with the Carthaginians, and conquered them. He made an expedition to Lower Italy, and starved out Rhegium (387). After another short war with Carthage, he had a period of peace, and composed poems and tragedies, with which he contended at the Olympic games. In 368 he tried to drive out the Carthaginians, and was shortly after poisoned by his successor. Dionysius had three great objects in his policy—to make Syracuse supreme in Sicily, to drive out the Carthaginians, and to subdue the Greek cities of Lower Italy. The fortifications erected by him are still one of the sights of Syracuse.

Dionysius the Younger (367-343 B.C.) was chiefly noted for the excesses of his life. His brother-in-law and guardian Dion tried to reform him, and caused Plato to visit him more than once and exert his influence. But Dionysius banished Dion and confiscated his property. In 357 Dion made himself master of Syracuse, and Dionysius fled; but after the death of Dion he regained the power. Timoleon, who came from Corinth with aid against the Carthaginians, deposed him in 344. Dionysius went to Corinth, and is said there to have given lessons in grammar. He died in 343.

Dionysius of Alexandria, St., died in 264, was a native of Salus. The reading of St. Paul's works led him to embrace Christianity, and he became a disciple of Origen. He was appointed Patriarch of Alexandria in 248, and was a determined antagonist of the Sabellian heresy. His works were much admired, but only fragments of them remain.

Dionysius of Halicarnassus (70-6 B.C.), a Greek historian, critic, and rhetorician, went to Rome 30 B.C. There he lived for 20 years, learning Latin and amassing materials for his history of Rome. His *Romæ Antiquities* was in 20 books, and treated of history from the early times down to the First Punic war. Books 1-9 are entire, 10 and 11 nearly so, and there are fragments of others. He also wrote good essays upon Greek orators, a treatise upon the arrangement of words, and a work upon rhetoric.

Dionysus, or **BACCHUS** (and **IACCHUS** in the mysteries), in Greek mythology the god of wine, was born at Thebes, in Boeotia, of Zeus and Semele. According to one legend he was entrusted by Hermes to the Nymphs, who reared him upon Mount Nysa, whence his name. He is generally represented as wandering in the East with Satyrs and Menads. He conquered India; at Naxos he encountered and married Ariadne, who had been deserted by Theseus; in Thrace he smote Lycurgus with blindness; and at Thebes, Pentheus was torn in pieces on Mount Cithæron for insulting the rites.

He also changed the daughters of Minyas into bats. Sometimes Bacchus is represented as in the height of youthful beauty, accompanied by Bacchanals and drawn by panthers, and clothed in a panther's skin, bearing the thyrsus, and crowned with ivy and vine tendrils; at other times he is represented as older, and clad in Oriental raiment.

Diophantus of Alexandria, who lived in the middle of the fourth century, was the first Greek writer upon algebra. He also wrote 13 books of arithmetical questions, of which six still exist, and a work upon polygonal numbers.

Dioptrics, that part of optics which treats of light refracted by its passage from one medium to another in which the speed of propagation is different. *Catoptrics* is the old term for the part of optics relating to reflection of light. Hence the expressions dioptric and catoptric that were given by older philosophers to refracting and reflecting telescopes respectively. The terms are becoming obsolete.

Diorama, invented by Daguerre, is a panorama or range of painted pictures viewed through a small opening by means of reflected and transmitted light. [PANORAMA.]

Diorite, a basic crystalline igneous rock, including many of those formerly known as *greenstone*. It consists of plagioclase felspar, generally white, and hornblende, dark green or black, in varying proportions. There is usually some magnetite and minute needles of apatite present, and some varieties contain quartz or mica. *Corsite*, otherwise known as napoleonite or orbicular diorite, occurring in Corsica, contains globular aggregations an inch or two across, and is made up of greyish anorthite, blackish hornblende, and some quartz. *Acranton*, or mica-diorite, has mica partly replacing its hornblende. Diorites are mostly granitoid in texture, but may be porphyritic. Their average silica percentage is 54 and specific gravity 2.95. They occur in Palæozoic volcanic necks as eruptive rocks.

Dioscorides Pedanius, a Greek physician of the first century A.D., was a native of Cilicia. He wrote a valuable work upon *Materia Medica*, and his researches upon botany, in five books, have much merit, and are still of high authority in the East. He was a soldier, and travelled in Asia Minor, Greece, and Spain, studying natural history. The authorship of a treatise upon poisons, sometimes ascribed to him, is disputed.

Diospyros. [EBONY.]

Dip. 1. The dip or inclination of the needle at any point on the earth's surface means the angle made with the horizontal by the earth's magnetic force at that point. If a straight piece of steel wire be supported by a horizontal axle passing through its mass-centre, it will practically assume any inclination that is given to it. But if it then be magnetised it tends to adjust its length in the direction of the earth's magnetic force; and when placed in the magnetic meridian so as to point to magnetic north and south we find it will assume a definite angle of

inclination to the horizontal that is subject to very slight change from year to year. Such an action is due to the fact that the earth is a magnet, and just as in the case of a bar magnet a small needle is differently inclined to the two ends at different regions about the bar, so with the earth a dipping-needle shows a varying inclination at different points on the earth's surface. In the region of the earth's magnetic poles, which are not far removed from the geographical poles, dipping-needles point vertically downwards, and the inclination has its maximum value of 90° . Along a somewhat irregular line passing round the earth in the equatorial regions the inclination is 0° , and the needle therefore horizontal. This line is called the *magnetic equator*. Lines of equal dip are called *isoclinic* lines, just as those of equal declination are called *isogonic* lines. The magnetic dip in London at present is about $67^\circ 20'$. It has been steadily diminishing since 1720, when it attained a maximum value of $74^\circ 42'$. These observations are made with a *dip-circle*, which is a needle carefully supported at its mass-centre and capable of rotation in a vertical plane about a horizontal axis. It admits of accurate adjustment in the magnetic meridian, and possesses a graduated vertical scale for the measurement of the required inclination of the needle.

2. The inclination of a stratum of rock, or of a fault, to the horizon, the stratum in question being said to dip at such and such an angle towards such and such a point of the compass. Thus the angle is the *amount* of dip; the point of the compass the *direction*. Horizontal beds have no dip, vertical ones a dip of 90° . Dip is measured by a *clinometer* or plummet with a graduated semicircle. A line at right angles to the direction of dip is called the *strike*, being the general direction of the *outcrop* or exposed edge of the stratum. Thus beds dipping east or west will have a north and south strike. The Secondary rocks of England have a general direction from south-west to north-east in the southern half of the country and due north and south in the northern half, their general dip changing similarly from south-east to east. Whatever their inclination, beds appear horizontal along the line of strike, and it is only sections or exposures at right angles to this line of strike that exhibit the *true dip*. Other sections show *apparent dips*. The lower the angle of dip the wider will be the outcrop (q.v.), on level ground that of vertical beds being equal to their thickness. If, therefore, we know the angle of its dip and the width of its outcrop, we can readily calculate the thickness of any bed and can similarly estimate its depth below the surface at a moderate distance from any part of its outcrop. Where strata dip in two opposite directions from a line of elevation we have an *anticlinal* (q.v.) or *saddle-back*; where in all directions from a centre, a *periclinal*, *dome*, or *quaquaversal dip*; where from opposite directions towards a depressed axis, a *synclinal* (q.v.), or *trough*; where from all directions towards a centre, a *centroclinal* or *basin*.

Dip, or DEPRESSION, OF THE HORIZON. This is the sinking of the visible horizon below the true horizontal plane, when the observer's eye is raised

above the surface of the sea. Approximately, the dip, in minutes, equals the square root of the height of the eye in feet. Allowing for refraction, the dip at various heights is as follows:—

Height. Feet.		Dip, "	Height. Feet.		Dip, "
5	-	2 0	40	-	6 4
10	-	3 2	50	-	6 46
15	-	3 42	60	-	7 25
20	-	4 17	70	-	8 1
25	-	4 52	80	-	8 34
30	-	5 15	90	-	9 6
35	-	5 39	100	-	9 35

Diphtheria (Greek *diphthera*, a membrane or pellicle), an acute specific disease characterised by general constitutional disturbance, associated with a peculiar inflammatory condition involving the tonsils and surrounding parts, or the larynx. In rare instances a skin-wound or the conjunctiva of the eye may be affected by an inflammation of a diphtheritic character; the local mischief is, however, usually manifested in the throat. In a typical case of diphtheritic sore-throat the tonsils are red and swollen, and present certain patches which are at first difficult to distinguish from particles of secretion exuding from the tonsillar follicles such as may occur in cases of simple sore-throat, follicular tonsillitis, a disease quite distinct from true diphtheria. These patches, however, if the inflammation be really diphtheritic, usually extend, assume a greyish white or dirty yellow colour, and form distinct pellicles on the surface of the mucous membrane. On attempting to strip off such a pellicle ("false membrane," as it is called), the subjacent mucous membrane bleeds readily. If the case be a severe one, extensive sloughing occurs, the breath becomes exceedingly foul, the glands of the neck undergo considerable enlargement, and the constitutional disturbance is great. The mischief is apt, too, to extend to the larynx, producing hoarseness and difficulty of breathing, which latter may assume very grave proportions, and terminate, if unrelieved by operation, in actual suffocation from blocking of the air-passages with false membrane. Diphtheria was first recognised as a distinct form of disease early in the 19th century by a French physician, Bretonneau. In Scotland cases similar to those described by Bretonneau were designated croup (q.v.), and there has resulted a great deal of discussion as to whether croup and diphtheria should be regarded as co-extensive terms. Pathologists have adopted the expressions croupous and diphtheritic inflammations, and have attempted to distinguish between the two by the microscopical appearances of the mucous membranes affected. [CROUP.] Practically, it is nowadays considered advisable to look upon all forms of sore-throat in which false membrane is detected, whether in the pharynx or the larynx, as contagious.

The symptoms of diphtheria are general and local. The first general symptom is sometimes a rigor or an attack of vomiting. More often the commencement of the disease is very insidious. There is usually, when the disease is established, some fever present, but the temperature does not as a rule attain any considerable degree of elevation. Indeed, prostration and collapse are marked features

of the most severe cases. The pulse is small and feeble, the tongue dry and brown, the skin cold, and death, if it do not originate from local complications, usually occurs by syncope. The urine is generally found to contain albumen, sometimes in considerable amount.

The local symptoms are those of sore-throat, or, when the larynx is involved, of laryngitis, rapidly culminating in marked dyspnoea. The larynx is particularly apt to be involved in young children; the disease in them may apparently involve the larynx from the first. A "croupy cough" is rapidly succeeded by difficulty of breathing, with marked inspiratory recession of the chest-wall. If this condition is allowed to continue, cyanosis supervenes, and death occurs from suffocation. In such instances the only measure which will produce relief is tracheotomy. Unfortunately, in many cases, however, the benefit following upon the operation is only temporary, as the disease extends downwards, involving the lungs. Still, in not a few instances the temporary benefit gains a respite for the patient, in which the force of the malady spends itself, and recovery supervenes.

Certain sequelæ of a troublesome nature sometimes appear after an attack of diphtheria. The most common is a group of symptoms known as *diphtheritic paralysis*. There is some loss of movement in the muscles of the soft palate, with consequent difficulty in swallowing, and regurgitation of fluids through the nose. There may, too, be paralysis of the limbs, affection of the ocular muscles, loss of sensation, and loss of "knee jerk."

Diphtheria is said to affect damp situations. It has been attributed to insanitary surroundings, and the poison is said to be communicated by milk. The discharges from the inflamed surfaces are eminently contagious, and careful disinfection should be insisted upon. The attendants upon the patient should avoid inhaling his breath.

The treatment consists in securing rest in bed, and adopting every means of supporting the patient's strength. Stimulants are usually required, and tonics, especially iron, may be given with benefit.

The discovery in recent years of *anti-toxin* has been of great value in the treatment of the disease.

There are great differences of opinion as to local treatment, some advising the mere employment of some antiseptic gargle, while others place great reliance upon radical methods of dealing with the local trouble. When the larynx is involved, a warm moist atmosphere is generally procured for the patient by employment of a steam kettle. The most unremitting attention to the sufferer is necessary, as aggravation of the symptoms may occur in the most sudden and alarming manner, requiring the immediate performance of the operation of opening the trachea. During convalescence tonics are invaluable, and after the lapse of some weeks a change of air will be probably deemed advisable. Paralytic symptoms, when they occur, are often very intractable. Electricity is often employed with benefit in the treatment of such cases at time of incubation.

Diphthong (Greek *dis*, twice; *phthoggos*, sound), commonly defined as "the union of two vowels in one sound." Strictly speaking, however, both the vowels are pronounced, and an intermediate sound, technically called a *glide*, develops in the passage from one to the other, there being no definite break between them. Diphthongs, of course, often arise from simple sounds (*cf.* German *mein*, Old German *min*), and also become simple sounds (*e.g.* the German *ä*, from *a-e*). The term, of course, refers to the spoken rather than the written language.

Diploma (Greek, from *diplōos*, twofold), originally a double and folding tablet. At the end of the Roman republic, and under the early empire, it was applied to any official document or letter of recommendation giving special privileges to particular persons (*e.g.* the privilege of availing themselves while travelling of the facilities usually confined to officials). Afterwards the word seems to have been applied, though not commonly, to all official documents (whence "diplomatics," a synonym for palæography). It was revived in the seventeenth century, and variously used, sometimes only for documents issued by kings and emperors, as contrasted with papal "bulls." The name is now usually given only to the documents which attest the conferring of an academic degree on their holder, or his admission to membership in some learned corporation; and in Germany to patents of nobility.

Diplomacy, the practical knowledge and application of the methods and rules of the intercourse of civilised nations. The study and formulation of these rules and methods arose as the Holy Roman Empire was weakened and the great military states of modern Europe grew up, from the fifteenth to the seventeenth centuries. The governments of these States were mostly despotic, and in all cases the management of affairs was in fewer hands than at the present time. Diplomacy, therefore, commonly involved minute knowledge and observance of Court etiquette, considerable judgment of character, and a very high degree of astuteness and tact, combined very often with complete freedom from scruples, especially in dealing with unscrupulous persons. Hence the somewhat unfavourable associations the term has acquired in popular language. In modern times, owing to the growth of democracy and public opinion, the peculiarities of the persons composing the government of a country usually count relatively for less than they once did; and the invention of the telegraph and other rapid means of communication have tended to leave less to the individual ambassador than formerly. He is now commonly instructed by telegraph almost daily in all important international negotiations.

Classes of Diplomatic Agents. As disputes had often arisen between the representatives of different countries at a foreign Court as to their precedence and the ceremonial to be observed in receiving them (as to which there was much minute regulation and much jealousy), the Congress of Vienna, on March 19, 1815, fixed the following classification: (1) Ambassadors, Legates, or Papal Nuncios; (2)

Envoys or Ministers accredited to Sovereigns; (3) *Chargés d'Affaires* accredited only to the Minister of Foreign Affairs of the country to which they were sent. In 1818 a class taking precedence of *Chargés d'Affaires*—viz. Ministers Resident—was formally recognised by the protocol of Aix-la-Chapelle, but these are not numerous. Some French Consuls-General are also *Chargés d'Affaires*. *Envoys Extraordinary*, strictly speaking, are sent on special missions, and take precedence over ordinary Ministers of the second class; but to secure this precedence, ordinary Ministers of this class often take the title of "Envoy Extraordinary and Minister Plenipotentiary." *Commissioners* to settle special questions—e.g. of disputed boundary—are a lower and special class of diplomatic agents. [CONSUL.]

Diplomatics. [PALÆOGRAPHY.]

Diplopoda. [MILLIPEDES.]

Dipnoi, an order of Palæichthyes, containing fishes which breathe both by gills and lungs. [CERATODUS, FISHES, MUD-FISH.]

Dippel's Oil, or ANIMAL OIL, a dark brown liquid obtained by the destructive distillation of animal matter, such as horns or bones. [BONE OIL.]

Dipper, any bird of the genus *Cinclus*, of the family Turdidæ (Thrushes), with nine species, all widely distributed in the Palæarctic region, and ranging to the alpine parts of America. The bill is straight, the nostrils are partly covered by a membrane, the feet large and strong. They are restless birds, frequenting the banks of clear streams, and often entering the water in search of the small molluscs, insects, and larvæ, on which they feed. One species, *C. aquaticus*, the Common Dipper or Water Ouzel, is British. The length of the male is about nine inches, brownish black above, white on the upper part of the breast, chestnut-brown on the belly. Its popular name has reference to the peculiar movements of the bird, which ducks its head and lifts its tail many times in succession as it pours forth its twittering song. The nest is a domed structure of felted moss, with a hole in the side, and is concealed with great art, generally near the water. The eggs are white, four to six in number, and there are usually two broods in a year.

Diprotodon, the largest known marsupial, a giant extinct kangaroo found in Tertiary caves, lacustrine and fluviatile deposits, in Australia. Its fore limbs were longer and its hind limbs shorter in proportion than those of the living kangaroos, but it was probably six times as large as the largest existing species, its skull measuring three feet in length.

Dipsas, the type-genus of Dipsadidæ, a family of nocturnal tree-snakes, chiefly from the Oriental, Ethiopian, and Neotropical regions. They are innocuous, and are distinguished from the tree-snakes (Dendrophidæ) by their nocturnal habit, and from the whip-snakes (Dryophidæ) by their dark coloration. [DENDROPHIS, DRYOPHIS.]

Dipsomania (Greek *dipsao*, I thirst; *mania*, madness). [ALCOHOLISM.]

Diptera, the class of insects which includes the Flies. The character of the order is the possession of a pair of clear transparent wings. The hinder wings may be completely aborted, but usually persist as the "halteres" or balancers. The mouth appendages form a proboscis. The metamorphosis is complete, for the larvæ are active but footless worm-like maggots. The character of the wings and the rudimentary nature of the posterior pair are the two most prominent characters. The wings are never clad in scales or hairs, and have few veins: most of these are longitudinal. In some cases the number of wings appears to be four, as there is a pair of winglets or "alulæ," but these are only lobes of the anterior wings. The two main orders are the Nemocera and Brachycera. The Fleas were once included as a division of the Flies, but are now generally regarded as a distinct group, the Aphaniptera (q.v.). The principal flies are the House Flies (*Muscidæ*), the Crane Flies (*Tipulidæ*), the Gall Flies and Hessian Flies (*Cecidomyidæ*), the Gad Flies (*Sabanidæ*), the Robber Flies (*Asilidæ*), the Bee Flies (*Bombylidæ*), the Bot Flies: reference should be made to each of these. Fossil flies are rare, except those in amber. The order is a very large one: the British species probably exceed 4,000 in number. The flies are world-wide in distribution, occurring high on the flanks of the Andes and in high latitudes in the Arctic region. In many regions they are a source of serious difficulty, as they attack cattle and horses; some genera cause pestilence, from which man is not free, as in the case of *Lucilia*, which devastated the French convict settlement at Cayenne. In many parts of the world they occur in such abundance as to form veritable plagues, such as those of the genus *Simulium*, which have from time immemorial invaded Egypt, and are also met with on the sandy deserts of Western Australia.

Diptych (Greek *diptuchos*, double), properly a picture with two leaves or panels. In the early Church the name was applied to a register of benefactors, the living being on one panel, the dead on the other. Both were specially commemorated in the prayers of the Church. The diptychs were often adorned with painting or carving, and were sometimes of ivory. They are of considerable importance in the history of art.

Dipus. [JERBOA.]

Dirce, in Greek mythology, wife of Lycus, king of Thebes. Her jealousy led her to imprison Antiope, who escaped, and whose sons afterwards killed Dirce by fastening her to a wild bull. The group by Apollonius and Tauriscus representing this event is well known.

Direct Currents of electricity are those in which the electric displacements along the conductor take place continuously in the same direction. In this respect they differ from alternating currents, where the displacements are continually oscillating backwards and forwards. As for the advantages of either system in electrical engineering, no one is at present really qualified to give

an ultimate answer. Whereas direct currents are simpler to work, their instruments easier to design and understand, and their behaviour in novel combinations readily to be predicted, alternating currents, on the other hand, offer serious difficulties in each of these respects. But so little is known of alternating currents as yet that it is useless to condemn them on account of the above difficulties. Alternate current generators are certainly better in some ways [DYNAMO], and transmission of power by means of such currents is already the more convenient. Moreover, the recent researches of Hertz, Tesla, and others point to an immense extension of the principle of power transmission in an alternating system, and a fuller knowledge of this is hoped for and expected by many. Both direct and alternating currents may be used for the electric light, which depends for its production on the generation of a white heat in an imperfect conductor that offers considerable resistance to the motion of electricity. Inasmuch as such a conductor offers resistance to motion in either direction, its heating is continuous though the current be alternating. In electro-metallurgy, where currents are made to deposit metals from solution, a reversal of the current produces a reversal of the deposition. Alternating currents are in that case useless, direct currents alone being employed.

Directory, in French history. After the fall of Robespierre and the Committee of Public Safety, the more moderate party adopted "the constitution of the year III." By this the Legislature was to consist of a "Council of Five Hundred," who prepared the laws, and a "Council of Ancients," who sanctioned them. The former presented a list from which the latter chose five members, who were appointed directors, and in whom was vested the supreme executive power, and the appointment of ministers, and other officers of state. One Director was to retire annually. The Directory, consisting of Larévellière-Lepeaux, Rewbel, Carnot, Letourneur, and Barras, came into office on October 28, 1795. It was a *bourgeois* government, with a vigorous foreign policy, unpopular alike with Royalists and advanced Republicans, and to some extent chargeable with corruption. Hence it was almost destroyed by a Royalist movement in 1797, and was finally overthrown by Bonaparte's *Coup d'état* of 18 Brumaire, November 9, 1799, when it gave place to the Consulate.

Directory for Public Worship, a system of rules for the conduct of public worship in the Established Church of Scotland, adopted by the General Assembly of that Church in 1645, in place of the form of liturgy then in use and originally drawn up by John Knox. A similar set of rules, called by the same name, exists for the Free Church. Both in the main consist of suggestions rather than of set formulas.

Directrix, in the geometry of conic sections, a fixed line in a certain relation with a fixed point called the *focus*, and with the curves in question. From it the distances of all points on each curve are measured, and are found to bear a certain ratio

to the corresponding distances of the points from the focus.

Dirk (Gaelic *duirc*), a small dagger, part of the costume of a Highlander. The handle, projecting from the stocking, is a familiar feature of Highland costume. Also the side-arm of midshipmen in the British navy. This is a long heavy dagger, with a white handle.

Dirschau, a town of West Prussia, on the left bank of the Vistula, in the government of Dantzic. There is much navigation at this spot, and a considerable exportation of timber.

Disability, the incapacity of anyone to do a legal act. It is either (1) *absolute*, i.e. wholly disabling the person and his descendants or successors while it continues, or (2) *partial*. Instances of the former are, or were, outlawry, excommunication, attainder (*see* those titles); of the latter, infancy, coverture, drunkenness, and lunacy.

Disbar, the compulsory expelling of a barrister from the bar. It is a power vested in and exercised by the Benchers of the four Inns of Court, subject to an appeal to the judges. It is founded on professional misconduct, but is rarely exercised. [BARRISTER.]

Discharge, in *Electricity*, means the neutralisation of free electricity by a removal of the stress that has kept it in place. Thus a cloud of water-particles in the air may be heavily charged with electricity, and may be prevented from discharging itself by too great a thickness of air insulation between it and the earth or another cloud. This thickness of air is subjected to a stress, and may be insufficiently strong if the pressure or potential in the thunder-cloud becomes greater. This being the case a discharge takes place through the air to the earth or neighbouring cloud, and the tension is relieved. If a charged conductor be pointed, it will be found that the density of the electricity is much greater in the pointed regions, and that a silent convective discharge may take place there. [BRUSH DISCHARGE.] In *Hydraulics* the discharge of a river, weir, or other channel for the flow of water denotes the quantity of water that passes over in a given time. It will depend on the head of water and on the dimensions of the channel. The discharge may be estimated for small streams by triangular or rectangular *gauge-notches* (q.v.), through which the water is made to pass. In the case of large discharges, it is usual to calculate the quantity by means of observations on the average speed of flow and on the dimensions of the channel.

Discina, a genus of Brachiopoda, and the type of the family Discinidae. It is one of the hingeless genera belonging to the order Tretentherata (q.v.). The family ranges from the Lower Silurian to the present.

Disciplina Arcani (Lat. = discipline of the secret), a name given by seventeenth-century theologians to a rule in the early Christian Church by which unbaptised persons or catechumens were excluded from admission to the more solemn mysteries of the faith. Some catechumens, according to St.

Chrysostom, were even forbidden to use the Lord's Prayer, and were only allowed to read select parts of Scripture. This "discipline" reached its extreme in the fourth century A.D., and afterwards disappeared. The idea was doubtless borrowed from Paganism.

Discipline. THE TWO BOOKS OF, in the history of the Established Church of Scotland, are the two authorised statements of its organisation which impressed on it a distinctly democratic and non-episcopal character. The First Book, though not formally adopted, was laid before an assembly of clergy and Protestant noblemen held in Edinburgh in 1561, and signed by most of them in January of that year. It provided that each congregation should elect its ministers and elders, while superintendents, also elective, were to supervise each group of congregations. It was chiefly drawn up by John Knox, and the system it introduced was to a great extent suggested by the ecclesiastical organisation of Geneva under Calvin. The Second Book, sanctioned by the General Assembly of the Scottish Church in April, 1578, and formally adopted in 1581, enacted that no more bishops should be appointed, and subordinated those who already existed to the General Assembly. The government of the Church was transferred (1) in the first instance to the Kirk session, consisting of the ministers and elders; over this were (2) the Presbytery, consisting of the ministers of a district and the elders of each congregation; (3) the Provincial Synod, consisting of all the presbyteries of a given district; (4) the General Assembly, elected by the Presbyteries. The books are still the bases of the Presbyterian ecclesiastical order, and similar books exist for the Free Church, and some other dissenting bodies.

Discoboli, a family of Acanthopterygian Fishes, of which the Lump-sucker (q.v.) is the type.

Discoidea, is a well-known genus of fossil Echinoidea which includes two species which are typical of the Lower Chalk and Upper Greensand; the most conspicuous feature of this genus is the presence of a series of ten raised ridges along the inner lower side of the test (or shell); these radiate from the mouth. Around the mouth is a raised girdle for the support of the jaws; the exact relations of this structure have been much discussed.

Discoides, a family of Siphonophora (q.v.) in which the body (or technically the "cænosarc") has a disc-like form; in the best known genus, *Veleva*, this disc bears a strong vertical crest. Like all its allies of this group the Discoides are free swimming, and live upon the surface of the tropical and subtropical oceans.

Discophora. [HIRUDINEA.]

Discount, in *Commerce*, the sum allowed in reduction of payments made before they are due. Thus, if a bill of exchange for £100 payable one month after sight be paid at sight, the sum paid will be, not £100, but the sum which will produce such interest in one month as added to it would make £100; e.g. suppose the rate of interest were 6 per

cent. per annum, or 10s. per cent. per month, the "present value" of such a bill would be £99 10s. In practice, an additional deduction is made for commission and for insurance against the risk of eventual non-payment, according to the presumed solvency of the acceptor and endorser, if any, of the bill. The whole deduction is popularly called discount. The "Bank rate of discount" is the rate at which the Bank of England will lend money for short periods on first-class security, the money being lent by discounting bills. It is fixed weekly by the Court of Directors, not, of course, that they can bind other discounters, but because, as the largest holders of loanable capital, their statement of their terms for loans more or less determines the "money market." The rate, of course, is high when loanable capital is scarce (e.g. either when trade is very brisk, or during a panic), and low when it is plentiful (as during trade depression). Discount on sales, for cash, arises with the development of commerce and the increased opportunities for "turning over" capital. To secure that as much of his capital shall be employed as possible, the seller reduces his price for cash, recouping himself out of the profits due to his increased turnover.

Discovery, the process which enables one party to an action to obtain from the opposite side information upon oath. It is of two kinds: 1. Discovery by interrogatories of facts relative to the matters in question and within the knowledge of the party interrogated. 2. Discovery of documents relating thereto and in the possession of the party.

Disestablishment, the process of reducing a State Church (q.v.) to a Free or "voluntary" Church by depriving the State authority of the power either of appointing to ecclesiastical office or of taking any part in the settlement of disputed questions of doctrine and ritual. Thus in England the Crown is patron of many livings, and appoints to bishoprics, deaneries, and other ecclesiastical dignities, and determines ecclesiastical law through the State courts. Disestablishment would transfer these powers to persons or bodies appointed by the members (clerical and lay) of the Church of England. The process, however, would almost necessarily be accompanied by Disendowment, or diversion to other (probably secular) objects of property hitherto devoted to ecclesiastical uses.

Disinfectants. A distinction is often drawn between a disinfectant and an antiseptic (q.v.). The former is said to destroy, the latter only to arrest the development of germs. Thus all chemical disinfectants may by dilution be converted into antiseptics; but, on the other hand, it is most important that in the process of disinfection reliance should not be placed upon a mere antiseptic substance. Heat is the most reliable disinfectant. Distinction must be carefully drawn between dry heat and moist heat. No form of bacterial life can withstand for many minutes the action of boiling water. Dry heat of like degree, to prove equally efficacious, must be allowed to act for a longer time. In the disinfection of clothing, heat in some form

or other is applied. The best plan is to adopt some kind of steam-heating, and there are several forms of such apparatus now in the market. Steam possesses great penetrating power, and is much more reliable than is mere dry heat. Among chemical disinfectants perchloride of mercury takes the first rank. Its application to any article which is too valuable to destroy is, however, but limited. It is invaluable for the disinfection of morbid discharges, such as cholera-stools and the like. Carbolic acid is a much less powerful disinfectant than is the chloride of mercury, and to be effectual it should be used liberally and in concentration. Of popular disinfectants, chlorine, bromine, iodine, osmic acid, Condy's fluid, and corrosive sublimate seem to be the most certain in their action. In the disinfection of rooms, etc., sulphurous acid gas is commonly employed, this gas being generated by the ignition of flowers of sulphur. This method requires very thorough carrying out to be effectual. Chlorine gas is probably more reliable.

Dislocation (derived from two Latin words and signifying a *displacement*) is a term applied in surgery to the separation of the two surfaces of a joint arising from violence or from disease. In some instances the abnormality exists from birth, being acquired in the foetal state; it is then spoken of as congenital dislocation. Dislocations are described as *complete* and *partial*, and as *simple* and *compound*. By a compound dislocation is understood the condition in which matters are complicated by a skin-wound, which opens up the injured joint and admits air to its cavity. The chief symptoms of a dislocation are pain, impaired power of movement, and alteration in the natural shape of the parts. There are two main methods of treating a dislocation—viz. "manipulation" and "extension." When the surgeon has succeeded in restoring the parts to their natural position, or in "reducing the dislocation" as it is called, he applies some form of apparatus so as to keep the injured structures in place until healing is complete. Some of the more common forms of dislocation are dislocation of the lower jaw, of the clavicle, of the humerus, of the elbow-joint, of the thumb, of the hip-joint, and of the ankle-joint.

Dismal Swamp, THE, a marshy tract lying a little south of Norfolk, in Virginia, and extending into South Carolina, having an area of 150,000 acres and a length of 30 miles, with an average width of 10 miles. It was covered by trees and brushwood, but parts of it are now cleared and drained. Drummond's pond, in the middle, is a lake 7 miles long. A canal passes through it from Chesapeake Bay to Albemarle Sound.

Dispensation. In the Roman Catholic Church, the relaxation of a law in a particular case where circumstances render it inapplicable. Aristotle (*Ethics*, v.) pointed out that law, though universal, cannot possibly be so stated as to cover all cases, and that a higher justice or "equity" is required to meet exceptions. On this doctrine the Roman Catholic theory is based. The Pope, as the successor of St. Peter (to whom was granted the power

of binding and loosing), can dispense from such obligations to God as have been voluntarily undertaken, and also from all ecclesiastical laws. Bishops have a similar but less extended power; while priests can dispense from many obligations—e.g. fasting (in the case of illness, for instance). The term is also used, commonly in Protestant theology, to signify one of the different periods and methods of God's dealings with mankind—e.g. "the Jewish dispensation," "the New Testament dispensation."

Dispersion, in *Optics*, means the separation of rays of different refrangibilities when passed through a prism or lens. If a beam of light be composed of different colours, it will be split up into its constituents when passed through a prism; the rays will be deviated from their original direction, but each colour will be deviated differently. Thus, although at first the rays are all coincident, their ultimate directions are dispersed. Another prism of different transparent material may produce the same amount of dispersion between any two coloured rays, but with less deviation. It is by combining two such prisms that we are able to get a resultant deviation without any dispersion, and so to obtain more or less complete achromatism (q.v.). Newton thought that the deviation depended simply on the dispersion, and that no such combination could be effected.

D'Israeli, BENJAMIN. [BEACONSFIELD.]

D'Israeli, ISAAC (1766–1848), an English man of letters, was born at Enfield, in Middlesex, his father, Benjamin D'Israeli, being a Spanish Jew who came from Venice to England in 1748, and made a fortune. The son Isaac had no turn for commerce, but displayed a great taste for literature, which he was allowed to follow up. His first work was upon the abuse of satire, which was directed against "Peter Pindar." In 1791–1793 appeared the work by which most people know him—*The Curiosities of Literature*. In 1795 he published an *Essay on the Literary Character*, and later *The Loves of Meville and Leila*. In 1828–1831 appeared *The Life and Reign of Charles I.* Trouble with his eyes put a stop to other projected works, but in 1841 he produced *Amenities of Literature*. His son Benjamin D'Israeli (Lord Beaconsfield) published in 1849 an edition of his works, preceded by a notice of his life.

Dissection Wounds. If inoculation of the fingers or of other parts occur in the process of dissection or in post-mortem examinations, serious complications are apt to supervene. A condition of pyæmia (q.v.), in fact, may be set up, and may terminate fatally. Hence the necessity for the exercise of the greatest care in handling and dealing with tissues in which the processes of putrefaction are established.

Dissepiments, the transverse plates which cross the chambers from septa to septa in most corals. The plates are obliquely placed, and are never continuous right across a coral. Such complete horizontal plates are known as *tabulae*. [CORAL.]

Dissociation is a term applied to the gradual decomposition of a substance by heat into simpler components, generally two; the decomposition ceasing on stopping the supply of heat, and recombination gradually occurring as the temperature falls. The amount of decomposition thus increases with the temperature until it reaches a maximum, when the decomposition is complete. The rate of dissociation at first increases, reaches a maximum amount, and then decreases. Since the discovery of the phenomenon by St. Claire Deville, who gave to it the present name, the investigation of dissociation changes has been of great importance in physical and general chemistry. Thus the abnormal vapour-densities of many substances—*e.g.* phosphorus pentachloride (PCl_5), ammonium chloride (NH_4Cl), acetic acid, etc.—are satisfactorily explained in view of a partial or complete dissociation. For example, the compound NH_4Cl at temperatures at which it is vaporised, is dissociated into NH_3 and HCl (ammonia and hydrochloric acid gases), which recombine on cooling. As a result, the vapour-density found is only one-half that indicated by the formula. To obtain proofs that dissociation does occur, and to separate the products in such cases, various methods have been employed, and in many cases, as in the example given, the unequal rates of diffusion of the components [DIFFUSION] may be successfully applied.

Dissolving Views are produced by arranging two magic lanterns so that the light from each shall fall precisely on the same place. A view is then projected from one, the light of which is gradually cut off, and at the same time the light from the other is gradually turned on, so that the view projected from the first appears to dissolve into that projected from the second.

Dissonance, in *Acoustics*, means the want of harmony in the simultaneous sounding of different notes. Dissonance is produced when the frequencies of the various constituents do not bear any simple arithmetical relationship to each other.

Distemper, a disease affecting young dogs. It is analogous to the diseases of childhood which occur in the human subject, and, like them, is contagious, and an attack protects the system against any recurrence of the disease. The usual symptoms of distemper are catarrhal, the parts involved being the eyes, nostrils, and bronchi.

Distemper (from French *détremper*, to moisten), or **TEMPERA** (Ital. *mixture*), is a method of painting in which the colours are mixed with water and some gelatinous substance to keep them together. In Italy the juice of figs was used; in mediæval Germany, dilute yolk of egg and glue made from chippings of parchment. The surface of the walls to be decorated was commonly prepared by a thin coating of plaster, which, however, unlike *Fresco* (*q.v.*), was left to dry before the paint was applied. But the process is applicable to any material, and was used extensively in ancient Egypt and Babylon, in Greece, and to some extent in Rome, for internal mural decoration; but the colours will not resist exposure or damp. It was used in the Middle Ages for MS. decoration, and was the common process for panel

paintings till driven out by oil painting during the latter half of the 15th century. The old Italian and German panel pictures are in distemper. The brilliancy of some of the latter is due to the use of a varnish, of which the chief ingredient was wax. Distemper pictures are sometimes difficult to distinguish from oil paintings.

Distich (Gr. *dis*, twice, and *stichos*, row, line), a couplet, often epigrammatic in character.

Distillation is the separation of a volatile liquid from a non-volatile substance by the application of heat. If more than one volatile liquid be present, the distillation may also have for its object the partial or complete separation of the different products, as in *fractional distillation*. In cases where a solid is strongly heated so that it is destroyed and decomposed, with the evolution of gaseous products, the process is known as *destructive distillation*. The essential parts for a distillation are—(1) the *still*, the vessel in which the substance is heated; (2) the *condenser*, in which the volatile products are condensed to the liquid state; (3) the *receiver*, where the liquid is collected. For a simple distillation this is all that is required. In the chemical laboratory the still usually takes the form of a flask; the neck, into which a thermometer may be placed, being provided with a side-tube, which is connected to the Liebig's, or other condenser (*q.v.*); the receiver being either a flask or a bottle placed below the end of the condenser. In the arts, various forms of stills, generally of copper, and specially arranged condensers are employed, according to the nature of the special distillation for which they are required. When it is necessary to separate the products, the liquid is heated in the usual way, and the temperature slowly rises. The portions which boil off between fixed ranges of temperature are separately collected, and the portions re-distilled and again collected as before. By this means it is found, after a few distillations, that the greater bulk of the liquid can be obtained in a few portions, each boiling at a nearly constant temperature and nearly pure; but to obtain very pure substances by this means—*fractional distillation*—is a laborious and sometimes practically impossible process. Frequently different condensers, cooled to different temperatures, are employed, the least volatile liquid being first condensed, the more volatile portions passing on to following and colder condensers. Special forms of apparatus, in which the less volatile portions condense above the still and run back into it, are also largely employed both in the laboratory and the manufactory. In certain cases, as in the purification of mercury, distillation has to be effected under reduced pressure—*i.e.* in a more or less complete vacuum—and at other times, owing to the action of air upon some of the products, all the apparatus has to be kept filled with an inert gas, usually nitrogen or carbon-dioxide. Destructive distillation is employed little in pure chemistry, but largely in industrial process, as *e.g.* in the production of coal-gas.

Distomum. [LIVER FLUKE.]

Distortion means change of shape. When a

body is subjected to stress it undergoes a change of shape and is said to become distorted or strained. Strictly speaking, strain applies to any change in the dimensions of the body, whereas distortion applies to irregular change. A sphere compressed to a smaller sphere is strained but not distorted; a sphere compressed to an ellipsoid is distorted.

Distress, a mode by which the law allows a man to minister redress to himself by distraining the goods of another for non-payment of rent or other duties, or to distrain cattle, "damage feasant," that is doing damage or trespassing upon his land. The former species of distress is for the benefit of the landlord to prevent tenants from secreting or withdrawing their effects to his prejudice. As to the latter [**DAMAGE FEASANT**], as a general rule, all chattels and personal effects found upon the premises may be distrained by the landlord whether they belong to the tenant, his under-tenant, or a stranger; but to this there are many exceptions, too numerous to be mentioned here. In ordinary cases the most common exception is goods entrusted to the tenant in the way of his trade—as a watch sent to a watchmaker to be repaired. The landlord's powers are chiefly regulated by an Act passed in the second year of William and Mary as amended by the "Law of Distress Amendment Act, 1888," which made applicable to all tenancies some of the provisions applicable to agricultural tenancies only by the Agricultural Holdings Act, 1883. A landlord may himself personally exercise his right of distress, but it is usual and expedient to employ a broker, who is duly appointed to the office, and exercises it under certain rules.

Distribution, or **CHOROGRAPHY**, is that division of Zoology which deals with the geographical distribution of animals. It has a double value, as it throws much light both on the physical conditions and geography of past ages as well as on the lines along which the evolution of various groups of animals has proceeded. The distribution of land and water animals depends on such different conditions that it is best to consider them separately. Taking the land animals first, we soon see that the distribution does not depend simply on distance, which in fact has but a comparatively slight influence. Thus, if we compare the faunas of England and Japan we find many very striking resemblances between them; if, on the other hand, we compare those of Bali and Lombok, two adjacent islands in the Malay Archipelago, we find the faunas fundamentally different. England and Japan were probably once both connected to the great European and Asian continents, whereas Bali and Lombok are separated by deep sea and in all probability have never been united: the one has always belonged to the continent of Asia and the other to Australasia. The two main factors that control the distribution of any group are the power of migration and locomotion possessed by its members and the date of the appearance of the group in the life history of the world. Thus, with the former, we should expect animals that can fly to be most widely distributed; next to this would come those whose eggs or larvae would be most

likely to be carried about by birds or on floating timber. Those to which sea-water is most fatal would naturally be most restricted. Thus if we take the case of an oceanic island it is natural to find that its principal inhabitants are birds, rats that have escaped from passing ships, other small mammals and snakes that have floated across on timber, insects whose eggs or larvae have been carried by birds, etc.; animals, such as slugs, to which sea-water is absolutely fatal, are the rarest.

The date of the evolution of a group has an important bearing, because, if an old one, the main lines in its present distribution may have been laid down at a time when oceans and continents were differently arranged. Hence, if the world be mapped out into zoological provinces, different groups would yield very different divisions. For example, the best known arrangement of zoological provinces is that made by Mr. Sclater, and is based on birds. He divides the world into six provinces, the Palearctic (Asia, north of the Himalayas, Europe and Africa, north of the Sahara), the Nearctic (North America, except Mexico), the Ethiopian (Africa, south of the Atlas Mountains), the Neotropical (Central and South America), the Oriental (India and South-east Asia), and the Australasian. But the birds are probably the most recently developed group, and, therefore, in spite of their powers of flight, it is natural to expect them to agree most closely with existing geographical conditions. But if we take an old group such as the Tortoises (*Chelonia*) we only get five provinces. The first includes all Asia, Europe, North Africa, and North and Central America; the second consists of the rest of Africa; the third of South America and Madagascar; the fourth of Australasia, except New Zealand, which forms the fifth. The Lizards, again, have a very different distribution. The whole of the New World forms but one province; Africa, Europe, and Northern Asia form a second; India and South-east Asia form a third; Australia, New Guinea, etc., a fourth; while Madagascar and New Zealand constitute the fifth and sixth. The Snakes, Mammals, Amphibia, etc., also give different divisions, and thus the evidence of any one group is not sufficient to demonstrate that continental distribution has not always been the same as it now is.

An instance of the limitations on the distribution of a group caused by its later introduction is afforded by the absence of snakes from Ireland. The severance of England and Ireland was effected at a time when the climate had not fully recovered from the arctic cold of the Glacial period; hence though most animals could live in the country it was too cold for the snakes, who only entered the British area after the Irish Sea had separated Ireland.

In regard to marine animals, as the conditions of life are more equable, they have a wider range. We have to consider the range both in space and depth. The latter, or the bathymetrical range, depends on the supply of light and heat. Light can only penetrate to a limited depth, and the water below is dark, except for the light derived from the phosphorescence (*see*) of the animals. Similarly

below a certain depth the temperature of the water is constant at about 39° Fahrenheit; therefore, animals such as reef corals, which require a high temperature, cannot live below fifteen to thirty fathoms. The conditions in the deeper parts of the great ocean-basins are not very favourable to life, and therefore the animals that live in them are those that have been driven downward by natural selection from the more favourable shallower zones, where they were unable to gain a living; they have, as a rule, a somewhat bizarre aspect, and frequently possess features which were probably once possessed by the ancestors of the group. The deep-sea fauna has, therefore, frequently been regarded as a primitive one, but it is more probable that these characters have been reacquired and are secondary. The shallower zones have been divided into several divisions, known as the Coralline, the Laminarian, etc., but these terms have fallen into disuse. The marine zones now accepted are the littoral (down to 100 fathoms), the continental (from 100 to 1,000 fathoms), and the deep sea (below 1,000 fathoms).

In regard to distribution in space the main influence is as to whether the group is fixed or free; in some mollusca, such as the Scallops (*Pecten*), which are locomotive, the species have a world-wide distribution, while in other closely allied forms, such as the oyster, they are restricted within narrow limits. In many cases fixed forms have free-swimming larvæ and thus gradually become widely scattered. The general aspect of the littoral fauna is given it by the modifications assumed to enable its members to withstand currents and tides; thus they are fixed and flexible such as the Zoophytes; fixed, rigid, and strong as the Corals; low and flat, with plenty of power of attachment, as in Starfish, Sea-urchins, Crabs, and flat-fish; or they may burrow through sand and mud, as Cockles, Sandworms, etc.

It has been maintained that the deep sea is uninhabited and that the forms obtained from it are either dead animals that have fallen to the bottom or are picked up by the net near the surface. The operations of recent deep-sea exploring expeditions, such as the *Albatross*, working with closed nets, leave no doubt that there is a true abyssal fauna.

In 1855 Mr. A. Wallace stated the following propositions:—"Large groups, such as classes and orders, are generally spread over the whole earth, while smaller ones, such as families and genera, are frequently confined to one portion, often to a very limited district. In widely-distributed families the genera are often limited in range; in widely-distributed genera well-marked groups of species are peculiar to each geographical district. When a group is confined to one district and is rich in species, it is almost invariably the case that the most closely-allied species are found in the same locality or in closely adjoining localities, and that, therefore, the natural sequence of the species by affinity is also geographical. Most of the larger and some smaller groups extend through several geological periods. In each period, however, there are peculiar groups, found nowhere else, and

extending through one or several formations. Species of one genus or genera of one family occurring in the same geological time are more closely allied than those separated in time. As generally in geography no species or genus occurs in two very distant localities without being also found in intermediate places, so in geology the life of a species or genus has not been interrupted. In other words, no group or species has come into existence twice." From these facts he deduced the law that "every species has come into existence coincident both in space and time with a pre-existing closely-allied species." In other words, the succession of plants and animals in geological time and their geographical distribution can only be explained on the theory of descent or evolution, and when so explained the facts of succession and distribution are hardly less important as indicative of affinity or pedigree than are those of embryology and comparative anatomy.

As to geological succession, we can only here make a few general remarks. The farther we go back the more unlike is the general assemblage of plants and animals to that which now exists. There has certainly been on the whole a steady advance in organisation, and an increase in variety and complexity, from the earliest geological periods to the present day. In each group, *generalised types*, combining, that is, the characters of two or more types which have subsequently become distinct, have preceded the more *specialised* or *differentiated* types. Thus the insects from the Palæozoic rocks have been grouped in an order, the Palæodictyoptera, combining the characters of the Neuroptera, Orthoptera, and Hemiptera, whilst such Eocene Ungulata (q.v.) or hoofed animals as Palæotherium and Anoplotherium, or such Carnivora as Cynodictis, combine the characters of horse, tapir, and rhinoceros, of pigs and ruminants, or of dogs and cats, these more specialised groups of mammals seldom occurring below the Miocene. The imperfection of the palæontological record, arising partly from the non-preservation of most land animals or of those destitute of hard parts, and partly from the subsequent destruction or metamorphosis of so many feet of fossiliferous strata by denudation or by heat, is so great as to prohibit all argument from negative evidence. Thus we know four species of fossil mammals from Triassic rocks, none from the Lias, four from the base of the Bath Oolite, and none from any part of the Jurassic series until we come to the Purbeck, and then in one small area one bed has chanced to yield us 25 species. Some of the Triassic forms, all of which are Marsupialia (q.v.), are herbivorous, others are carnivorous; so that the primitive mammal was presumably Palæozoic. Similar reasoning led Darwin to the conclusion that before the curiously varied series of Invertebrata that occurs in the Lower Cambrian (q.v.) system could have lived, "long periods elapsed as long as, or probably far longer than, the whole interval from the Cambrian age to the present day, and that during these vast periods the world swarmed with living creatures."

Botanists subdivide the Northern division into three floras, the Arctic-Alpine, the Temperate, and

the Mediterraneo-Caucasian. The Arctic-Alpine occupies the northern parts of both Old and New Worlds, with many interesting detached areas, whither it was carried in Glacial times, includes saxifrages, gentians, cranberries, rhododendrons, and primroses. The Temperate includes the zone of needle-leaved pines and firs, succeeded southward by that of deciduous catkin-bearing broad-leaved trees, and is marked by the cultivation of apples, potatoes, wheat, barley, and oats, by numerous Compositæ, such as asters, in America, and by Umbelliferae, such as the giant cow-parsnip, in Siberia. The Mediterraneo-Caucasian flora is largely evergreen, including myrtles, laurels, evergreen oaks, a fan-palm, and the area of the cultivation of maize, almonds, olives, figs, grapes, and oranges. The Tropical division, characterised by large evergreen trees, palms, and bamboos, includes the Indo-Malayan or Oriental flora, that of ginger, rice, mango, tea, and teak; the Tropical African, that of date, and oil-palms, baobabs and spinous euphorbias; and the Tropical American, that of the ivory-palm, rose-wood, caoutchouc, and mahogany. The Southern division includes the Australian flora, that of gum-trees and Epacris; the South African, that of pelargoniums, heaths, everlasting and carrion-scented stapelias; the Andine, represented from Tasmania and Victoria to Western America, the flora of Fuchsia and Calceolaria; and other scattered floras.

Distribution. [POLITICAL ECONOMY.]

District of Columbia. [COLUMBIA.]

Dithyramb (Gk. *dithyrambos*, perhaps originally a name of the god Dionysus), originally a hymn sung by a chorus round the altar of Dionysus, celebrating his sufferings and triumph. (Most probably Dionysus in one aspect is the productive powers of Nature, which are overpowered in winter but triumph again in spring and summer.) Its invention is ascribed by Herodotus to Arion (q.v.), but most probably he only gave it a more artistic form. While it gave rise to tragedy (q.v.) it was developed into an independent branch of poetry, chiefly by Lasos of Hermione, who was the court-poet of the Pisistratids at Athens. Pindar (q.v.) and Simonides were important dithyrambic poets. Contests of dithyrambic choruses were held at Athens till after the Peloponnesian war, and dithyrambic poets are known till the middle of the 4th century B.C. Their subjects were mythological, but had long ceased to be confined to the sufferings of Bacchus. But the style, we are told, declined and became turgid and bombastic.

Ditmarsch, a district lying between the Elbe and the Eider, forming part of the old Duchy of Holstein, and the present Prussian province of Schleswig-Holstein. It was colonised from Friesland and Saxony, and was subdued by Charlemagne. But throughout the Middle Ages the district remained independent—a kind of lowland Switzerland—in spite of many efforts to subdue them, and it was said of them that they had neither lords nor head but did what they liked.

They did not really submit till weakened by religious quarrels in 1559. In 1773 they were incorporated in the Danish kingdom.

Diu, an island of Hindustan, belonging to Portugal. It lies to the north-west of the Kattywar coast, being separated from Gujerat by a narrow channel. It is seven miles long by two wide, and is seventeen miles north-west of Bombay. At the east end is the town of Diu, which has a good port and once had a good trade, but this has passed away from it. The soil is sterile and there is no good water, but ginger is to some extent cultivated. The island became Portuguese in 1575, but was afterwards lost and retaken.

Diâr (Jûr), a Negroid people of the White Nile, north-east of Gondokoro and south of the Bahr-el-Ghazal, who give their name to the Diâr affluent of the Nile, which flows through their territory. The term Diâr, meaning "Men of the Forests" or "Savages," is applied to them by their northern neighbours, the Dinkas, because they do not keep cattle. They are partly dependent on the Dinkas, but they call themselves Luo, and claim to be a branch of the Shilluk nation, whose language they speak with great purity. Like the neighbouring Bongos they are of reddish rather than black complexion, and although without cattle they breed goats, possess poultry, grow durra, beans, sesame, sweet potatoes, and ground nuts (*Arachis hypogæa*), and manufacture their own arms, chiefly spears and arrows, from the iron which abounds in their country. Besides iron smelting and forging, they make pottery and extract butter from the nut of the butter-tree (*Bassia Parkii*). The Diârs, who go nearly naked, show great affection for their children, and also carefully tend the infirm and aged. Since the middle of the 19th century they have suffered much from the Arab slave-hunters and from the exactions of the Egyptian officials. (Schweinfurth, *Heart of Africa*; Junker, *Travels in Africa*.)

Diuretics, substances which increase the amount of the urinary secretion. Diuretics either act by modifying the calibre of the minute arteries and so raising the blood pressure in the kidney, or by actually stimulating the epithelium of the urinary tubules. Among the former class, the vascular diuretics, may be mentioned such drugs as digitalis, scrophanthus, and squills, which raise the pressure in the arteries generally; and spirit of nitrous ether, turpentine, juniper, copaiba, savin and cantharides, which have mainly a local action affecting the renal blood-vessels. The diuretics which act upon the epithelium belong for the most part to the group known as saline diuretics (certain salts of potassium, sodium, and lithium). Certain of the aromatic oils and oleo resins act, however, in a similar manner.

Divan (Persian, plural of *dir*, God), properly an assemblage of supernatural beings; hence applied to the council of a prince, and transferred, first to the highly ornamented chamber in which such councils were held, and next to a common article of furniture in it—a kind of settee or sofa. It was

also applied to a collection of poems—a use imitated in Europe by Goethe.

Diver, any bird of the genus *Colymbus*, constituting the family *Colymbidae* with three species, all confined to the seas of the Arctic and North Temperate zones. The bill is straight and strong, about as long as the head; nostrils basal; the legs very far back, with three toes all webbed, in front, and a small hind toe; wings short; tail short and rounded. All live out at sea, except during the breeding season; they are strong on the wing, and dive with great ease, pursuing fish, on which they feed, under water. The great Northern Diver, Loon, or Ember Goose (*C. glacialis*), which generally breeds in the Arctic regions, coming southwards in winter, when it is not uncommon on our coasts, is from 30 in. to 36 in. long. The head is black with metallic lustre, cheeks and back of neck dull black; back black, spotted and streaked with white, the markings becoming longer towards the breast; neck and upper part of breast white with black spots, and two rings of black: breast and abdomen white. Immature birds are greyish black above and dull white beneath. *C. arcticus*, the Black-throated Diver, is about 26 in. long, and is boldly barred with black and white on the back and tertiaries; the back of head and neck light ash, chin and throat black. It is a common water visitant, and sometimes stays to breed in the northern parts of Great Britain. *C. septentrionalis*, the Red-throated Diver, about 24 in. long, brownish-grey above, white below, with a conical red patch on the throat, is common in the estuary of the Thames. It may often be seen pursuing shoals of sprats, whence it is called the Sprat Loon, and in Scotland, where it is considered to be a harbinger of bad weather, it is known as the Rain Goose. Sometimes the term Divers is used so as to include penguins, puffins, grebes, etc., and then the species of *Colymbus* are called Northern Divers.

Dividend (Lat., *dividendum*, to be divided), the sum available as net profits for division among the shareholders of a railway, bank, or trading company annually, or at such other times as may be fixed. Varying with the profitability of the enterprise, it must be distinguished from interest on debentures, which is fixed, and no part of which is "earnings of management" in the economic sense. Also, the sum available from a bankrupt's estate to be divided among his creditors in part payment of their claims.

Dividing Engine, a machine for engraving or otherwise marking linear and angular scales. The cutting edge is generally controlled by an accurately turned screw-thread, by means of which the cutter is ranged along the scale at equal distances, and made to mark off a straight line in each position.

Divi Divi, the commercial name for the pods of *Casalpinia coriaria*, a small leguminous tree, native of Northern Brazil, Venezuela, Mexico, and some of the West Indian Islands. The pods are 2 to 3 inches long, $\frac{3}{4}$ inch broad, flattened, twisted in drying like the letter S, and of a rich brown colour.

The large percentage of tannin they contain makes them valuable in tanning and in dyeing. They are chiefly exported from Maracaibo.

Divination, the act or art of predicting future events or of discovering hidden or secret things by supernatural power. The belief in divination is founded on the idea of the continuity of human life beyond the grave, and on the existence of spiritual beings more powerful than mortals, even though the idea of a Supreme Deity may not have been reached. But from the earliest times of which we have written record down to the present day, in every land there has been a striving after knowledge that transcends sensible things, and that cannot be acquired by ordinary means. In the opening chapter of his inquiry into this subject (*de Divin.*, i. 1) Cicero tells us that all nations believe in divination of some kind, and that it would be an excellent thing if one could be sure that divination really existed, for by it human nature would approach as nearly as possible to the power of the gods. And then, as a Roman, he glories in the name *divination* as derived from the Latin word *divi* = "the gods"; while the Greeks, he says, call it *manteia*, from the same root as *mania* = "madness." Yet when one considers that madness was formerly supposed to be the result of possession by spirits, the superiority of the Roman to the Greek name is not so evident. [ANIMISM.] No better example of the supposed connection between possession and divination can be found than Acts xvi. 16. Divination is generally reckoned as of two kinds—(1) *Natural*, or *subjective*, in which the divine will is directly impressed on the mind of the diviner; and (2) *Artificial*, or *objective*, in which the divine will is conjectured from something external to the diviner. The first form is distinctly religious, and there are countless examples of it in the higher faith. In classic times, oracles, dreams, and ecstasies were the means by which the will of the gods was directly revealed to men; and this method of communication led to the formation of a class of persons who received these messages for, and interpreted them to, their fellows. Fraud crept in in process of time, as was inevitable; but the foundation on which the theory of divination was built was faith. As Professor Rhys says, in his *Hibbert Lectures*, "Zeus was the source of all divinations; the rustling of the wind in the leaves of the sacred oaks at Dodona, the voices of the waves, and the bubbling of the spring near the sacred oak, were all held to be oracular; and even in the case of the celebrated oracle of the Pythian Apollo, at Delphi, the latter was no more than the *prophetes*—or mouthpiece, so to say—of Zeus." In the Hebrew Scriptures the term "divination" is used for the most part of dealings with the gods of the heathen nations; but there are many examples among the chosen people of what present-day writers can call by no other name. Thus, Joseph dreamed prophetic dreams (Gen. xxxviii. 5–11), and interpreted the dreams of others (Gen. xl., xli.), as also did Daniel (Dan. ii., iv.), and both asserted that their interpretations were from God. In the New Testament, also, Joseph, the spouse of Mary, had revelations from God in dreams (Matt. i. 20; ii. 12, 19–22). We read in the Old and New

Testament of lots being drawn by divine command; from above the Mercy Seat Jehovah revealed his will; and in the days of Samuel (2 Sam. xvi. 23) it had become an oracle. Moreover, there was the line of prophets inspired to declare the divine will to the children of Israel, so that the diviners against whom the denunciations of Scripture are directed are evidently those of the Gentiles. Analogy or symbolism lies at the root of *artificial* or *objective divination*; and though this may be hidden from us, to those who used the rites it was real enough. Few now can understand Bunyan's wishing to stake his salvation on his power to cause the puddles in the road between Elstow and Bedford to dry up; Elijah would have understood it and sympathised with it (cf. 1 Kings xviii. 23). The principal forms of artificial divination were:—*Aeromancy*, from appearances in the sky; *aleuromancy*, by meal; *astragalomancy*, by dice or huckle-bones; *belomancy*, by the flight of arrows (Ezek. xxi. 21; 2 Kings xiii. 15–19) [Robin Hood is said to have chosen his burial-place in this way]; *bibliomancy*, by opening a book at random, and drawing conclusions from the passage which meets the eye; *botanomancy*, by writing on leaves; *capnomancy*, by the movements of smoke; *cartomancy*, by writing on paper; *catoptromancy*, by mirrors; *cheiromancy*, by lines on the hands [PALMISTRY]; *ciromancy*, by the melting of wax; *cleromancy*, by lots; *coscinomancy*, with a sieve and shears; *crystallomancy*, by looking into a crystal, as did the famous Dr. Dee; *dactylomancy*, by the fingers; *demonomancy*, by the suggestions of evil demons, or devils; *geomancy*, by lines drawn on the ground; *gyromancy*, by circles; *hepatoscopy*, by inspection of the liver (Ezek. xxi. 21)—this was, however, but one form of the *haruspicio* of the Romans, which was based on the appearance of the entrails of sacrificial victims; *hydromancy*, by water; *idolomancy*, by idols or figures; *lithomancy*, by stones; *machæromancy*, by swords and knives; *necromancy*, by apparitions of the dead; *oneiromancy*, by dreams; *oinomancy*, by wine; *onomatomancy*, by names; *onychomancy*, by marks on the nails; *pyromancy*, by fire; *rhodomancy*, by a rod or staff [DIVINING ROD]; *scapulomancy*, by lines on a shoulder-blade that has been partly burnt; *sciomancy*, by shadows; and *theriomancy*, by wild beasts. [AUGUR, DEMON- OLOGY, DREAMS, OMENS, ORACLES, MAGIC, WITCH- CRAFT.]

Divine Right, in English history, the right claimed by the king to rule as the vicegerent of God on earth, independently of the will of the people. The doctrine, though contrary in principle to the traditions of the English constitution, seems to have grown up throughout Europe partly from misapprehended maxims of Roman law (see Allen, *Royal Prerogative*), partly from the transfer to mediæval kings of the attributes of the Hebrew kings of the Old Testament, and the use of a similar ceremonial at their coronation. The rise of the Tudor monarchy after the practical extinction of the old nobility in the Wars of the Roses, gave the theory a chance of practical application. But it never took root in the English mind. An elaborate exposition of it by Sir Robert Filmer in his *Patriarcha*

(written before 1648) bases it on the doctrine that the king of a nation represents Adam and Noah, to whom God granted the earth, as recorded in Genesis, and that he inherits their dominion by primogeniture (a divine law), and rules the nation as a father rules his family. This absurd form of the doctrine was demolished by Locke, but it lingered on through the next century, and doubtless is now held by Legitimists. The power of "touching for the king's evil" (for which a form of service existed in the English Prayer Book as late as 1719) was ascribed to the king in virtue of his divine right as early as the reign of Edward the Confessor.

Diving, the art of immersing one's self in, and remaining under, water for limited periods. It is pursued with or without the aid of artificial appliances. The chief difficulties to be contended



DIVERS.

with are lack of air and pressure of water, the latter, even at slight depths, being considerable, and at great ones terrible. A practised naked diver has been known to subsist under water for a little over two minutes, but the time is, of course, insufficient for the performance of much work; and, to enable divers to prolong it, many devices have been made use of. The earliest of these is the Diving Bell, a strong vessel usually made in the form of a truncated cone, with the smaller and upper end closed and the lower one open. It is so suspended that, when lowered into the water with the diver inside it, it may sink full of air, and with its base parallel with the horizon. The air hinders

the rise of water within, though the deeper the apparatus, the greater the pressure, and consequently the higher the rise. At thirty-three feet, when the pressure of the water equals that of the atmosphere, the bell becomes half full. To keep the water within limits, air under pressure is generally pumped into the bell. The diving bell was perfected by Spalding and others, but as its arrangements prevented the diver from going far away from it, it has, save for particular purposes, been generally superseded by one or other of the numerous forms of diving suits and helmets. The first diving suit seems to have been invented by Borelli. The principle, in its simplicity, is the placing of the diver's head in a water-tight chamber or helmet into which supplies of fresh air are continually pumped from above, the foul air being at the same time allowed to escape by means of a tube or a valve. The helmet is fitted with glass eyeholes. The bare principle has been developed in many directions. To some helmets are now attached reservoirs of compressed fresh air, which are placed under the control of the diver. Such is the apparatus of Rouquairol. Fleuss's helmet is connected with a portable supply of compressed oxygen, and arrangements are made whereby the air that has been breathed by the diver is purified by being passed through a solution of caustic soda. The wearer of such a helmet is, for a time, independent of communication with a boat or with the shore.

Divining Rod, a forked twig, usually of hazel, commonly called Moses' rod, which, freely held forth, will stir and play if any mine be under it." So Browne defined it, wisely adding "we are of opinion that it is a fruitless exploration." It was, and indeed still is, also employed to discover hidden springs, and remarkable stories are told concerning it, which are, however, capable of explanation without attributing occult power to the rod or the operator. The rod is laid lightly in the open hand, or held by the forks between the balls of the thumbs, and as the operator walks over the spot where the mineral or water is to be found, the rod is said to incline toward the object of search.

Divisibility, that property of matter which enables it to undergo extreme subdivision without loss of its distinctive qualities. In modern chemical theory infinite subdivision is regarded as impossible. A stage is reached with any substance beyond which further division will give us particles of new type. When this stage is reached the substance is said to have its constituent molecules isolated. Further division of each molecule will give atoms of matter, of like or unlike kind. An atom may conceivably be cut, but a portion of an atom would not possess the properties of matter—in perhaps the same way as a portion of a smoke-ring would not exhibit the curious characteristics possessed by the complete ring. The extent to which subdivision may be carried is readily instanced by many mechanical processes. A pound of cotton may be spun into a thread eighty miles long, the diameter of the thread being then only $\frac{1}{16}$ th of an inch. Lines have been engraved on glass for certain optical purposes, so close to one another that 20,000 are

ranged to the inch. A skilful gold-beater can hammer out this extremely malleable metal to a thickness of $\frac{1}{1000000}$ th of an inch, and by a simple mechanical process a layer of gold may be deposited on white satin or ivory of a thickness not exceeding the ten-millionth part of an inch. A fibre of spider-web is only $\frac{1}{100000}$ th of an inch in diameter, but Professor Boys has devised an ingenious method for obtaining quartz fibres that are far thinner. The fact that the marble steps leading to many sacred shrines are so little worn away in the course of centuries by the feet of innumerable pilgrims give some idea of the slowness of the rubbing at each contact. That certain substances such as iron, musk, or lavender possess distinct effluvia shows that they must be emitting particles continually. A single grain of musk will give a distinct perfume to a room for over twenty years. An estimate of the number of particles that must have been emitted in that time to produce the observed effect can only be rough; nevertheless, it is safe to say that the number must be estimated in quadrillions. Numerous instances can be adduced in the case of liquids, but the above are sufficient to illustrate the astonishing tenuity of matter that can be attained before the atomic limit is reached.

Division, a process in arithmetic, the converse of multiplication. It cannot be performed without a knowledge of the latter, and is essentially a systematic guess-work. Thus in dividing 37 by 13 we have first to hazard a possible answer and then see if it is right by direct multiplication. This uncertainty is diminished by experience with the *divisor* or number by which we are dividing, but is generally manifest when such a number contains several digits. The number divided is called the *dividend*, the answer is the *quotient*.

Divorce, the judicial dissolution of the marriage tie. It may be obtained at the instance of either husband or wife; but they are not upon an equal footing as to the grounds upon which it will be granted, for in the case of the husband seeking divorce it is grantable to him on his proving the adultery of his wife only, whereas in the case of the wife she must not only prove adultery but also cruelty or desertion for two years, or incestuous or bigamous adultery, or an unnatural offence, against her husband. The proceedings for a divorce are commenced by a petition addressed to the President of the Probate, Divorce, and Admiralty Division of the High Court of Justice. The rules and orders issued under the Judicature Acts do not apply to divorce proceedings or to proceedings for a judicial separation, and the practice in these matters is the same as it was under the old Court for Divorce and Matrimonial Causes. Every person petitioning for a divorce must set forth concisely the particulars of his or her case and the alleged conduct of the respondent or respondents in detail, and the petition must be accompanied by an affidavit verifying the facts therein alleged so far as they are within the petitioner's *personal* knowledge, and stating that there is no collusion or connivance between the deponent and the other party to the marriage.

And on a petition for divorce presented by a husband, he must, unless excused by the Court on special grounds, make the alleged adulterer a co-respondent. It is also required that every petition shall be served on the party to be affected thereby, and after such service the next step is to issue a citation which, as a rule, must be personally served, and is in effect a writ of summons to the respondent or co-respondent, subject to the rules specially promulgated for proceedings in the Divorce Court. An appearance is then entered by the respondent or respondents, after which the answer, verified by affidavit, is filed in the Registry and, if necessary, further pleadings take place between the parties. With reference to the trial the judge will himself, on application, as soon as the pleadings are ended, direct whether the action shall be tried by a jury or before the Court itself, and whether by oral evidence or by affidavit; but in case of divorce the trial must be in open Court and not in camera, and either party may insist on a jury, whose intervention also is necessary in all cases in which damages require to be assessed against an adulterer. [ADULTERY, JUDICIAL SEPARATION.]

A Royal Commission on Divorce was appointed in 1910, and held its first sitting on February 25th. Lord Gorell (ex-President Probate, Divorce, and Admiralty Division of the High Court) was chairman, and the other eleven members included the Earl of Derby, Lord Guthrie, Lady Frances Balfour, Sir Rufus Isaacs, and Mr. Thomas Burt, M.P. Its sittings extended over six months, and a very wide range of evidence was taken, particularly in regard to the need, or otherwise, for greater facilities for divorce or separation among the poorer classes.

Dix, JOHN ADAM (1798-1879), an American statesman and general, born at Boscawen, in New Hampshire. He became a soldier at fourteen, and distinguished himself in the war against England in 1812. After sixteen years' service in the Artillery, he became an advocate in New York. He was in Congress and in the Senate 1845-49. He was opposed to the extension of slavery and advocated free trade. In 1861 he became Buchanan's Financial Secretary of State; participated in the War of Secession; suppressed the Conspiracy Riots in 1863; was French ambassador 1866-69, and governor of New York State 1872-74. He is not unknown as a writer.

Dixon, WILLIAM HEPPORTH (1821-1879), an English author, was born at Manchester. In 1849 he published a sketch of the life of Howard the philanthropist, in 1851 one of William Penn, and in 1852 one of Admiral Blake. In 1853 he became chief editor of the *Athenæum*, and in the following years, besides his work upon this, he published the *Personal History of Francis Bacon* (1862), *The Holy Land, New America* (1867), etc.

Dizful, a Persian town, near the western boundary of the country and upon a river of the same name. It has a considerable trade, and many manufactures.

Djessar, AHMED (1720-1804), an eastern ruler, born in Bosnia. He is said to have sold himself to Ali Bey in 1755, and he became successively a Mameluke, Governor of Cairo, and Governor of Beyrout in 1873. In 1875 he was Pasha of St. Jean d'Acre, and he subdued Syria in spite of the remonstrances of the Turkish Government. It was at this time that he earned his name, which means "the Butcher." In 1799 he defended St. Jean d'Acre against the French forces.

Djinn. [JINN.]

Dnieper, THE, a river of Russia, anciently the Borysthenes. Next after the Volga and the Danube, it is the largest river in Europe. It rises in the Lake Mchara in the government of Smolensk, and flows S.W., S.E., and S.W. into the Black Sea. With a length of 1,230 miles, it is navigable to a little above Smolensk, and receives among other tributaries the Beresina, Desna, Pripet, and Psiol. The Oginski canal unites it with the Niemen, that of Horodetz with the Vistula, and that of Beresina with the Duna. There are important fisheries in its lower course. Between Kiev and Alexandrovsk are a series of cataracts, but these impediments to navigation have been overcome in part by blasting. A service of steamboats has existed since 1838, and there is much trade. The only bridge is at Kiev, and this is taken away during the freezing up of the river in winter.

Dniester, THE (anciently the Tyras), rises in the Carpathian Mountains, in Austrian Galicia, and flows N.N.E. and S.E. into the Black Sea, entering Russia at Chotin. It has a course of 750 miles. The navigation is much impeded by shallows and rapids. The water is muddy and unwholesome, but full of fish.

Doab (lit. two waters) is a generic name much used in India. The space between the Ganges and the Jumna is specially called the Doab, but the Punjab—the land of five rivers—has four Doabs.

Dobell, SYDNEY (1824-1874), an English poet, was born at Cranbrook, in Kent. His first poem, *The Roman*, was well received upon its appearance in 1850. Other of his works are *Balder*, *Sonnets on the War*, *England in time of War*, etc.

Döbeln, a town in the kingdom of Saxony, 40 miles S.E. of Leipzig. The town is built upon an island in the Mulde, and has a large trade in grain, and manufactures of cloth, yarn, leather, lacquered ware, etc.

Dobereiner's Lamp, which takes its name from that of its inventor, depends for its action upon the fact that if a jet of hydrogen be allowed to impinge, in air, upon spongy platinum, the gas ignites and the metal is heated to incandescence. The lamp simply consists of an arrangement by which a supply of hydrogen can be readily obtained, the nozzle through which the gas issues being directed upon a support which holds the platinum sponge.

Dobrovsky, JOSEPH (1753-1829), a learned Jesuit, who was born near Raab, in Hungary. He studied at the University of Prague, and became

successively vice-rector and rector of the seminary of Hradisch, near Olmutz. He gave his attention specially to the study of the Bohemian language, literature, and history. He wrote an introduction to a German-Bohemian Dictionary, a system of the Bohemian language, and the plan of an Etymological Dictionary of Slavonic. He also wrote upon the old Slavonic dialects.

Dobrudja, THE, a territory in the S.E. of the kingdom of Roumania, bounded on the N. and W. by the Danube, on the E. by the Black Sea, and on the S. by Bulgaria. It was assigned to Roumania by the treaty of Berlin on the 13th July, 1878. A railway of 59 miles from Tchernavoda to Kustendje is on a road, made in 1855 by the French Government, from the Black Sea to the Danube. The chief industries are the rearing of sheep and beasts, the keeping of bees, fishing, and the manufacture of salt. The population is very varied, containing among others Roumanians, Bulgarians, Tartars, Cossacks, Greeks, Turks, Jews, and Germans. The capital is Babadagh.

Dobson, WILLIAM (1610-1647), an English painter, who benefited by the advice of Vandyke, whose manner he in some degree approaches. He was brought to Court, and painted portraits of Charles I., the Prince of Wales, Prince Rupert, and many of the courtiers.

Dobson, WILLIAM CHARLES, R.A., was born in 1817. He showed an early taste for art, and after studying at the British Museum, entered as a student at the Royal Academy in 1836. In 1843 he was appointed headmaster of the Government School of Design at Birmingham. This post he resigned two years later, and went to Italy and Germany to study. He became A.R.A. in 1860, and R.A. in 1873, being also a member of the Society of Painters in Water Colours. He died in 1898.

Docetae (Gk. *dokein*, to seem), a name given to a section of the Gnostics, who believed that the body of Christ was a mere appearance, or phantom. They thus denied the reality of the Crucifixion, the Resurrection, and the Ascension, and virtually the Atonement. The doctrine arose from the Neo-Platonist view that matter was essentially impure; hence, it was argued, a Divine Being could not have taken on Himself a material body. Saturninus, Marcion, and Tatian were among the leaders of the sect.

Dock, an artificial basin, divided from sea or river, especially if the waters be tidal or subject to fluctuation, by water-tight gates. The object of a wet dock is to secure a depth of water wherein ships may float alongside of a wharf or quay independently of tides, currents, and freshets; and these docks are designed to assist the prompt and safe completion, repair, loading and unloading of vessels. Dry docks are docks which, after ships have been admitted into them, can be emptied of water, leaving the vessels completely exposed for examination or repair. The mouth of such a dock is usually closed by a gate similar to a lock gate, or by a caisson. The London Docks were opened in 1805, the West India Docks in 1802, and the East

India Docks in 1806. These are mainly wet docks. The largest dry docks in England are in the royal dockyards.

Dock, the name commonly applied to a section of the genus *Rumex*, insipid herbaceous plants, many of them well-known weeds in grass land. The leaves are pinnately veined and rounded at the base; the flowers are in whorls and are generally perfect, with a six-leaved perianth, six stamens, and three styles. The nut-like little fruit is three-cornered, and superior.

Dockyard, an arsenal of nautical stores and materials of all kinds, wherein ships may be built or repaired, moored, fitted, and commissioned. The royal dockyards in the United Kingdom are at Portsmouth, Devonport, Chatham, Sheerness, and Pembroke, and there is also a yard available for certain purposes at Haulbowline, Queenstown, and there were formerly yards at Deptford and Woolwich. Abroad there are also British naval dockyards at Gibraltar, Malta, Halifax, Jamaica, Bermuda, the Cape of Good Hope, Ascension, Trincomalee, Hong Kong, Esquimalt (Vancouver's Island), and Sydney. Deptford was established in the time of Henry VIII.; Woolwich, about 1509; Chatham in the reign of Elizabeth, and, on its present site, about 1622; Sheerness, about 1661; Portsmouth in the reign of Henry VIII., if not before; Devonport, or Plymouth, prior to 1691; and Pembroke in 1815, prior to which year it had been a temporary yard. Portsmouth is now the most important naval dockyard in the world. It contains twenty-four dry docks, or locks and basin entrances which may be used as such, enormous basins, storehouses, factories and machine works; and it could, in case of necessity, accommodate in dry dock a ship 650 feet long and nearly 80 feet broad. Owing to their importance as headquarters of the fleet, all the royal dockyards are strongly fortified. The French naval dockyards are at Toulon, Cherbourg, Brest, L'Orient, and Rochefort; the German at Kiel and Wilhelmshaven; the Italian at Naples, Spezia, and Venice; the Austrian at Pola and Trieste; the Russian at Cronstadt (St. Petersburg), Sebastopol, and Nicolaieff; and those of the United States at Brooklyn (New York), Charlestown (Massachusetts), Gosport (Virginia), Kittery (New Hampshire), League Island (Pennsylvania), Mare Island (California), New London (Connecticut), Pensacola (Florida), and Washington.

Doctor (Latin *a teacher*), a university degree, originally an alternative title to that of master [DEGREES], and said to have been first conferred in the faculty of laws at Bologna in the twelfth century. It was conferred in Paris about 1150, and in the first half of the next century in England. The absence of the degree in the faculty of arts in England, and its comparative rarity in those of law and divinity, have tended to make the term a popular synonym for "medical man." Many of these, of course, have strictly no claim to the title. In Germany and some American universities the degree of "Doctor of Philosophy" (Ph.D.) exists for graduates in arts (literature or science). London University grants the degrees of Doctor of Science

and Doctor of Literature; and Cambridge has recently introduced a Doctorate of Science and one of Letters, which are reserved for men of very high eminence. Ph.D. is not usually taken in Germany save by those who take up learning as a profession.

Doctors' Commons, originally a society of civil and canon lawyers in London, licensed to practise in the ecclesiastical courts of the province of Canterbury. In 1567 the then Dean of Arches, Henry Harvey, purchased a site for them on St. Benet's Hill, near St. Paul's Cathedral. On this were built the Ecclesiastical and Admiralty Courts, as well as houses for the Vicar-General, the Chancellors, for the Archbishop of Canterbury, and the Bishop of London, and the members of the society. This was incorporated by Royal Charter, the president being the Dean of Arches for the time being, and the members all Doctors of Law of Oxford or Cambridge as were licensed to practise in the Ecclesiastical Courts. There were also licentiate, or proctors, licensed to practise, who may be remembered by readers of *David Copperfield*. In 1887 the Corporation was empowered by Act of Parliament to sell its estate, and dissolved; and ecclesiastical practice is now open to all members of the bar. Some of the legal business of the province of Canterbury is still transacted on the old site.

Doctrinaire, in *Politics*, strictly speaking a man who holds fast to abstract doctrines in all circumstances. Thus most of the French revolutionist leaders might be called doctrinaires. But the term was invented by the ultra-royalists in France just after the Restoration of 1814, and applied to a moderate Liberal group headed by Royer Collard (q.v.), and including at various times the Duc de Broglie, MM. Camille Jordan, Guizot, and others. This group professed to base their principles on the study of French history, and attacked both the revolutionists for their contempt of the past and the royalists for their reactionary tendencies. They have thus been treated as an offshoot of the great movement towards the study of history as a development, which began early in the 19th century. Politically their doctrines might be called moderate Liberalism, at least relatively to those of the ultra-royalists. They supported constitutional monarchy and parliamentary government, but they opposed extension of the franchise, disapproved of a free press, protested against the notion that parliament should represent the views or wishes of the nation, and held that the king should govern as well as reign. Probably, therefore, they did more harm than good to the cause of constitutional monarchy in France. Louis Philippe's government more or less represented their views. After its fall in 1848 they disappeared from public life. The Orleanists carry on their traditions.

Dodd, WILLIAM, LL.D. (1729-1777), an English clergyman, born at Bourne in Lincolnshire, and educated at Clare College, Cambridge, and chiefly remembered because he was hanged for forgery. He was chosen by the Earl of Chesterfield as his son's tutor, and afterwards he won renown as a

London preacher, and became chaplain to the king in 1766. Speculation in proprietary chapels seems to have landed him in financial difficulties, and in an ill-advised moment he forged his patron's (the Earl of Chesterfield's) name. In spite of powerful intercessions the sentence of death was carried out. Dr. Johnson took much interest in his fate. Among Dr. Dodd's literary works are *The Beauties of Shakespeare*, *A Commentary upon Milton*, and *Thoughts in Prison*.

Dodder, the popular name of the genus *Cuscuta*, some fifty species related to the Convolvulaceæ, all of them natives of temperate regions, and annual, leafless, twining parasites. Their seed is albuminous, and the embryo spiral and thread-like, with hardly a trace of cotyledons. It germinates in the ground, and on coming in contact with the stem of a herbaceous plant sends out sucker-like branches or *haustoria*, penetrating the cortical and bast-tissues of the host, while it coils round it like a tendril. It then loses all connection with the ground and grows rapidly into a tangle of red thread-like stems, containing hardly any chlorophyll, but bearing numerous clusters of small 4 to 5-merous flowers, succeeded by two-chambered capsular fruits containing four minute seeds. Several species are destructive to flax and clover crops, their seeds being sown with those of the crop.

Doddridge, PHILIP, D.D. (1702-1751), an eminent Nonconformist minister, was born in London. The Duchess of Bedford offered her influence on his behalf if he would become a Church of England clergyman, but he declined, and joined a Nonconformist body, and was for twenty-two years a pastor at Northampton. He wrote many hymns and treatises, and his *Rise and Progress of Religion in the Soul* and his *Family Expositor* are well known by name. He also lectured upon many subjects. He went to Lisbon in search of health, and there he died. He was not bigoted, but allowed the use of cards and tobacco.

Dodgson, CHARLES LUTWIDGE, an English writer, better known as "Lewis Carroll." Born in 1833, he was educated at Christ Church, Oxford, where he graduated as B.A. in 1854, afterwards taking orders and becoming Senior Student of Christ Church; he was a distinguished mathematician. His *Alice's Adventures in Wonderland* in 1865 achieved a wonderful success, as did his *Alice Through the Looking-Glass* in 1872. These works have been translated into many languages, and there are few, young or old, who are not familiar with "The Cheshire Cat," "The Duchess," "The Mock Turtle," and "The Jabberwock." Other writings of the same author are *The Hunting of the Snark*, *Phantasmagoria*, *Euclid and his Rivals*, *A Tangled Tale*, and *Game of Logic*, *Sylvie and Bruno*. He died in 1898.

Dodington, GEORGE BUBB (1691-1762), originally Bubb, he took the name Dodington upon inheriting some property in 1720. In 1715 he entered Parliament, and sat for Bridgwater from 1722 to 1754. Beyond his diary he is chiefly known for his fickleness, but he has the merit of having spoken



out on behalf of Admiral Byng. He became Baron Melcombe before his death.

Dodo (*Didus ineptus*), a large bird allied to the pigeons. It was abundant in Mauritius, to which it appears to have been confined, but became extinct towards the close of the seventeenth century, within a little less than forty years after the colonisation of the island by the Dutch. The fact that it was excellent eating was perhaps the chief factor in its extermination, but the dogs, pigs, and cats introduced by the colonists largely contributed to



dodo (*Didus ineptus*).

this result, for many of them became more or less feral and fed on the eggs and the young birds. The dodo—from the Portuguese *dundo* (= stupid), the name given it by the discoverers of Mauritius—was a heavy, helpless bird, about the size of a turkey, with short stout legs, rudimentary tail and wings and very large bill, the upper mandible hooked at the point. The plumage was shades of grey, with some yellow on the wings and tail. Some specimens were brought alive to Europe, and remains exist in various museums. In 1866 in draining a swamp in Mauritius a large quantity of bones was discovered, and from these the skeleton was practically reconstructed, so that the question of the affinity of the dodo to the pigeon was settled.

Dodona, in Epirus, one of the most famous and most ancient of Greek oracles. It was the seat of Zeus, and the intentions of the oracle were communicated by the rustling of leaves upon the surrounding forest trees, or by the murmur of a brook that sprang beneath a sacred oak, or by the solemn clang of copper vessels suspended from the temple, said to have been founded by a priestess of Egyptian Thebes, who was sold by the Phœnicians to the Greeks. Constantine Carapanos has explored the ruins, and in 1878 wrote a book upon them.

Dodsley, ROBERT (1703-1764), an English poet, dramatist, and publisher, was born at Mansfield. Besides the tragedy of *Cleone* he wrote the famous farce (1736) *The King and the Miller of Mansfield*. He further wrote *Fables in Verse* and an *Essay upon Fables*. He planned the *Annual Register*, which first appeared in 1758. He is perhaps better known for his twelve volumes of old plays and six volumes of poems by different hands. Pope and

Chesterfield patronised him, and his early efforts were encouraged by Dr. Johnson.

Doe, the female of the buck (q.v.), and like that word used attributively, of rabbits, goats, etc.

Dofla. [DAFLA.]

Dog, the book name for any species or individual of the family Canidae, constituting the Carnivorous division Cynoidea (q.v.). The term is also used for any variety or individual of *Canis familiaris*, the Common or Domestic Dog, the principal breeds of which are described in separate articles. The division Cynoidea partakes of the characteristics of the other two [ELUROIDEA, ARCTOIDEA], and the three (Cats, Dogs, and Bears) make up the family Carnivora. In the Cynoidea there are five digits on each of the fore, and four on each of the hind limbs, except in the Cape Hunting Dog; and these animals walk on the tips of their toes like the cats, not on the sole of the foot, as do the bears. A rudimentary hallux or "dew-claw" is often present in the domestic dog. The claws are not retractile, though the ligaments which draw them back in the cats are present. Owing to this the mode of attack in the two groups (Dogs and Cats) is essentially different. The cats strike down their prey, the dogs seize it with their teeth. The distinction will be clear to anyone who has seen a domestic cat and a terrier tackle a rat, and the action of the smaller forms is identical with that of the larger ones. The dental formula is usually the same as that of the bears, and some of the molar teeth are adapted for grinding. The diet is for the most part carnivorous, but many of the smaller forms eat carrion, insects, fish, crustaceans, and vegetable substances. They are very widely distributed, being absent only from Madagascar, the Antilles, Austro-Malaya, New Zealand, and the Islands of the Pacific. Their senses are well developed, that of smell in an extraordinary degree. Many of the wild forms in various parts of the world hunt in packs, and show great pertinacity in running down their prey. The period of gestation is nine weeks; the young, usually from four to eight in number, are born blind, and continue in that state for nearly a fortnight. The mother is an affectionate parent, but the sire is entirely neglectful of his offspring. Following Professor Huxley, the family may be divided into two groups, with two aberrant members—(1) The *Thooïd* or *Lupine* section, containing the Wolves, Jackals, and the Dogs proper, so-called wild, and domesticated [DINGO, DHOLE, JACKAL, WOLF]; and (2) The *Alopecoid* or *Vulpine* section, containing the Foxes and fox-like forms. [FENNEC, FOX.]

The Dog (*Canis familiaris*) has been known from a very remote period. Its remains are found in the Kitchen-middens of the Neolithic period; and on Egyptian monuments "from the fourth to the twelfth dynasties (i.e. from about 3400-2101 B.C.) several varieties of the dog are represented." But the origin of the race is lost in obscurity, though Darwin's opinion that "the breeds of the domestic dog throughout the

world are descended from several wild species" is generally accepted as well as his conclusion, of which there is practical proof, that some are due to selection on the part of the breeder. [BREED.] The probability of his theory is shown by the fact that savages so far apart as the Eskimo and the Australian have reduced wild dogs to domestication, and the former have trained them as draught animals. In wild dogs the ears are erect and pointed and the tail is straight; in the domestic dog the former generally droop, and the latter is curling. The only constant difference, however, is the habit of barking, which is only acquired after long association with man. The domestication of the dog is of vast importance to man, for it has given him not only a faithful servant but an attached companion and a devoted friend; and long training and intercourse with man has so developed the intellect of this animal that some of the stories told of its feats would not be credited did they not rest on the best authority. On the continent of Europe the dog is used in many places for draught, but this is illegal in the United Kingdom. In China its flesh is eaten and is said to be well flavoured, and in Manchuria dog-farms exist where dogs are bred for the sake of their skins, which are used as robes.

The Cape Hunting Dog (*Lycaon pictus*) from South and East Africa is about the size of a mastiff, with large erect ears and drooping tail. In its markings it bears some resemblance to the Spotted Hyæna (*Hyæna crocuta*), whence it is sometimes called the Hyæna-Dog. It hunts in packs, but not infrequently feeds on carrion.

The Long-eared Fox (*Otocyon* or *Megalotis lalandii*), from South Africa, is scarcely as large as a fox, with greyish-yellow fur on the upper surface and white beneath. It has six molars more than any other member of the group, two above and one below on each side.

The Raccoon Dog (*Canis* or *Nyctereutes procyonides*), from North-Eastern Asia and Japan, has the body covered with long brown fur, the back arched, short slender legs, and short bushy tail. It differs from the true dogs in external appearance only.

Pariah Dogs are feral dogs, met with in troops in most of the towns of the East, where they act as scavengers, and it is probably to animals of this class that the Biblical allusions to dogs refer.

Dog Days, a period of the summer commonly reckoned from about July 3rd to August 11th; by Pliny connected with the rising of the dog star (whether Sirius or Procyon is meant is not clear) which he dates on July 17th. The most unhealthy time of summer frequently, but by no means always, coincides with this period. The ancients attributed great influence over the whole of the animal kingdom to these stars; probably because the heliacal rising of the dog star Sirius, called Sothis by the Egyptians, coincided with the extreme of the overflow of the Nile. Of course the whole notion is a survival of astrological superstition.

Dogars, a Jât people of North-West India, numerous especially in North Rajputána and the

province of Moultan. Small Dogar communities are also met in Hansi, Ferozepore, and along the banks of the Sutlej, where they were the ruling people in the 18th century. The Dogars, though now Mohammedans, claim descent from the renowned Chohan tribe of Rajputs; but they are more probably Aryanised Jâts, and are regarded as such by the Rajputs themselves. They are a pastoral people, at all times much dreaded by their neighbours for their predatory habits. Physically they are tall, muscular, with regular features, large aquiline nose, and pleasant appearance, quite distinct from the Dogras of South Kashmir, with whom they are often confounded. (See Elliott, *Races of the North-Western Provinces of India*, volume i.)

Doge (a corruption of Latin *duces*, acc. of *dux*, leader), the chief magistrates of the republics of Venice and Genoa. In the former the Doge was originally elected by the whole people for life. The first Doge, Paolo Luca Anafesto, was elected in 697. The election was transferred to the Council of Forty [VENICE] in 1172, and the first Doge elected by them was Sebastiano Ziani. The growth of a hereditary aristocracy who monopolised the real power of government practically deprived the Doge of all but ceremonial functions, such as the well-known annual wedding of the Adriatic. At the same time an extraordinarily complicated method of election was introduced. The office was abolished in 1797 on the French occupation. The last Doge was Ludovico Manin. At Genoa, Doges were elected for life till 1528, afterwards for two years only.

Dogfish, any species of Scyllium, the type of a family (Scylliidae) of Cartilaginous Fishes from temperate and tropical seas. They are small sharks with two dorsal fins, an anal fin always present, a distinct spiracle, and have no nictitating membrane. The species of the type-genus live near the bottom, feeding on dead fish and on crustaceans, though they are by no means particular in their diet. Two species are British: (1) *S. canicula*, the Rough Hound, or Lesser Spotted Dogfish, about two feet long, rufous gray, spotted with brown above, and yellowish below; and (2) *S. catulus*, the Nurse Hound, or Larger Spotted Dogfish, somewhat like the former, but of larger size, and with larger markings. The eggs are deposited in oblong horny capsules, locally known as mermaids' or sailors' purses, with a long filament at each corner, which moor the egg-case. The flesh of these fish is dry, though it is sometimes eaten. *Pristiurus melanostoma*, the Black-mouthed Dog, is also British. The Spiny Dogfishes belong to the genus *Acanthias*. *A. vulgaris*, the "Picked" dogfish, so called from its spinous dorsal fins, common on our coasts, is viviparous. It is detested by fishermen for the damage it does to their nets and lines, and for its ravages among food fishes.

Dogger, a bluff vessel of Dutch origin, chiefly used for fishing, fitted with a main and mizen mast, and somewhat resembling a ketch. It is so named because it is most commonly seen on the Dogger-bank, the great fishing ground in the North Sea.

Doggerbank, a sand-bank of the German Ocean, renowned as a favourable spot for cod fishing. It begins about 36 miles N.E. of Flamborough Head, and stretches E.N.E. to within 60 miles of Jutland, and is about 170 miles long, diminishing from a breadth of 65 miles to a point. In the shallowest part it has 9 fathoms of water.

Doggett, THOMAS (died 1721), a popular actor born at Dublin, and chiefly remembered for the rowing-match for Doggett's coat and badge, which is rowed upon the Thames on the 1st of August by six watermen who are in the last year of their apprenticeship. The coat is orange and the badge is the Hanoverian White Horse.

Dogma (Greek *an authoritative opinion, a decree*), in *Theology*, a doctrine accepted as matter of faith, to be received without question as of divine authority. While Protestant theology, however, holds that only that is dogma which can be shown to be Apostolic, and that its proof must be sought solely in the Scriptures, some High Church Anglican theologians would also appeal to tradition; while the Roman Catholic Church holds that the decisions of General Councils of the Church on dogma are authoritative and that the Pope may from time to time so interpret tradition as to declare that certain doctrines are dogmas of the Church. The development and history of Christian dogma, and the interdependence and mutual relations of the articles of the Christian faith, are dealt with by the study known as "Dogmatic Theology," which has been much studied of late years, particularly in Germany. The names of Harnack and Dorner may be mentioned in this connection.

Dogras, a historical people still dominant in Jammu, that is, the outer hills of South Kashmir, skirting the north frontier of Panjáb, and called Dúgar, a contraction of the Sanscrit Dvīgārtadēś, "Land of the Two Valleys." The Dogras appear to be fundamentally Mongolic Jāts assimilated in speech, religion, and even appearance to the surrounding Aryan populations, with whom they have been in close contact for ages. Chief castes: Rajput, including the Mians and working Rajputs; Khātrī (traders, munshis, etc.); Khatar (peasants); Banya and Krār (hucksters); Nai (barbers); Jiūr (carriers); Dhiyar (smiths); Megh and Dām (scavengers, charcoal-burners, brickmakers, etc.). The low castes are the direct descendants of the pre-Aryan hill tribes, who were reduced to slavery by the Hindu invaders. Dogri is a Neo-Sanscritic language intermediate between Hindi and Panjáb, and current throughout Jammu; it is written with two alphabets, both modifications of the Devanagari. All the Dogras belong to the Hindu religion, except the Western Chibālis, who occupy the left bank of the Jhelum, and who are Moham-medans. They are a small people, about five feet four inches high, physically weak, with light brown or almond complexion, jet black curly hair, deep brown eyes, slightly snub nose, and well-formed mouth (Fr. Drew, *Jammu and Kashmir*).

Dog-ribs, THE, North American aborigines, who belong to the Chipewayan division of the

Athabaskan race. [CHIPPEWAYAN.] The Dog-ribs are the Slaves, Slávés and Yellow-knives of the Franco-Canadian and English trappers; but they call themselves Thing-à-la-dtinné, and their domain lies chiefly about the Great Bear and Great Slave Lakes, the latter named from them. In this region the medium of intercourse is the so-called "Slave jargon," a Dog-rib dialect mixed with Cree, Franco-Canadian and English elements. The Dog-ribs, who are so named from the national legend of their canine descent, are amongst the few North American Indians who practise the rite of circumcision. They are largely employed as trappers and carriers by the Hudson Bay Company, which maintains the two important stations of Fort Rae and Fort Simpson in their territory.

Dogs, ISLE OF, or MILLWALL, a peninsula on the left bank of the Thames caused by a sudden bend of the river opposite to Greenwich. The isthmus is crossed by the canal of the West India Docks. The etymology of the name is doubtful, but it is thought to commemorate the lodging there of the King's hounds.

Dogwood, a name commonly applied to the cornel or skewer wood, *Cornus sanguinea*, a common British shrub with purplish-red branches, ovate leaves which turn red in autumn, and flat cymose clusters of white flowers which are succeeded by blackish-purple fruits. The name is also applied to the wood of the alder-buckthorn or berry-bearing alder, *Ithamnus Frangula*, which yields a very superior quality of charcoal for gunpowder.

Dolci, CARLO (1616-1686), a painter of the Florentine school, born at Florence where, too, he died. His subjects consist largely of Saints and Madonnas, and his style has been described as "sweet and melancholy." A French writer calls him "le peintre favori des Anglais." He was a pupil of Jacopo Vignali. His *St. Cecilia at the Organ* and *Herodias with the Head of St. John the Baptist* are at Dresden, *St. Andrew in Prayer* in the Pitti Gallery, and his *Christ on the Mount of Olives* in the Louvre. Bartolozzi has engraved his *Virgin Suckling the Child*.

Dôle, the Roman Dola, a French town in the Jura, formerly the capital of Franche Comté. The town is on the right bank of the Doubs, and near the Rhine and Rhone canal. The chief industries are the manufacture of Prussian blue, hosiery, cast-iron ware, and leather, the rearing of silkworms, and tanning. The town is of great historic interest, once had a parliament and a university, and played an important part in mediæval wars. There are amphitheatres and aqueducts and other Roman remains.

Dolet, ETIENNE (1509-1546), a French writer born at Orleans. He took lessons from the best masters in Paris and Italy, and devoted himself to the study of Latin. He was appointed Secretary of Legation at Venice, and afterwards he studied law at Toulouse. Here he made an enemy of the Parliament, and he went to Lyons where he made fresh enemies by the "hardieesse" and satirical nature of his writings. In spite of the favour of Francis I.,

he was accused of unorthodoxy, and his books were burnt in 1543 by order of the Sorbonne, the "great Ciceronian" himself meeting three years later with the same fate as his books. Among his works were *Two Books of Commentary on the Latin Tongue* (1536-38), *How to Translate from one Language to Another* (1540), *De Imitatione Ciceroniana, How to Translate Well*. He translated bits of Cicero and Plato, and intended to translate the whole of the latter author.

Dolgans, a Tatar people of Central Siberia, settled on the Yenissei river between Dudinka and the Katangar river, where they are continuous with the Ostiaks. In appearance the Dolgans resemble the kindred Yakuts of the Lena basin, and like them speak a pure Türkic dialect, which shows certain marked affinities to the language current amongst the Tatar populations of Tobolsk, Tuimen and other parts of West Siberia (Seebohm, *Proceedings of the R. Geo. Soc.*, 1878). West Siberia was the seat of the ancient Tatar kingdom, many of whose inhabitants were driven east after the Russian conquest, and are now probably represented by the Dolgans of the Yenissei and the Yakuts of the Lena.

Dolgelly, a Welsh town, capital of Merionethshire, near the foot of Cader Idris. It has manufactures of woollens, flannels, and cloths, but is chiefly known for the beauty of the surrounding scenery. Pop. (1901), 2,437.

Doliolidae, a family of Ascidians (q.v.), which are free swimming; they are interesting from their cask-shaped form and as being among the few Ascidians in which the sexes are distinct. *Doliolum* is the type genus.

Doll. The use of dolls as toys goes back to a very early period of human history. In Assyria, in ancient Egypt, in Greece and Rome, dolls were common playthings. They offer a natural stimulus to the maternal instinct in girls; but as boys frequently play with them until they are laughed out of the practice, it is clear that this is an inadequate explanation of their use. They are probably played with rather as an imitation of the familiar actions of the mother or nurse than for any more recoudite reason. The immense development of the doll trade in modern times is due chiefly to Parisian taste. Wooden dolls (jointed), indeed, are made as a village industry in parts of Germany and Austria, notably at St. Ulrich, near Botzen, in the Tyrol, where the trade is highly specialised. India-rubber dolls date from about 1845. China dolls and the rag doll of our ancestresses have been largely supplanted by the handsome wax and composition dolls which are chiefly made in France. As an illustration of the elaboration of the doll's wardrobe it may be mentioned that (according to a *Pall Mall Gazette* interview) the trade price of dolls' kid gloves is 3s. 6d. a pair; while court dresses, ball dresses, walking dresses, and toilet appliances of the most elaborate kind—not to mention embroidered underclothing—have replaced the simpler attire of the dolls of past centuries, greatly to the detriment of childish

imagination and ingenuity. The question arises who buys all these things? It was stated a few years ago that the finest dolls and the most elaborate dresses find a large sale among grown-up young ladies in Spain, South America, and other Latin countries. The higher education has touched them but little as yet, and they find in dressing their dolls a stimulus and satisfaction to their interest in costume. It is also stated that the best dolls' toilettes are made in Paris, the requisite taste being hitherto unavailable elsewhere. Walking dolls (which are not as yet graceful in their movements) and speaking-dolls are American inventions, while a proposal has been patented for dolls with small phonographs in their chests, so that they will be able to repeat poetry or sing. Notoriously, however, these elaborate dolls which leave nothing to the imagination are not regarded with the human affection which attaches to the simpler dolls of childhood.

Dollar (Ger. *thaler*, perhaps from *thal*, a valley). The usual explanation of the name is that they were first coined in Joachim's Thal, Bohemia, about 1500 or 1512: a less probable etymology connects them with German *theil*, part, Eng. *deal*, distribute, share, because they were regarded as parts of a ducat (q.v.). Originally coined in Germany, the dollar passed to Spain and thence to Spanish America. It was familiar in the British colonies in America before the revolution, so much so that some people kept their accounts in dollars; and was adopted as the legal unit of value by the "Continental Congress" during the American revolution in 1785. In 1792 its weight was fixed by Act of Congress at 371½ grams of pure or 416 of standard silver. The silver dollar remained the legal unit in the United States till 1873, when the gold dollar of 25·8 grams weight (= 4s. 1½d.) was substituted by Act of Congress. The symbol \$ is said to be from Lat. *semis*, half (a ducat), or a combination of the figure 8 (the Spanish dollar being worth eight reals) with two lines borne by that coin to distinguish it from the dollars of other nations.

Döllinger, JOHANN-JOSEPH IGNAZ VON (1797-1891), a German theologian, leader of the Old Catholics. Born at Bamberg in Bavaria, he entered the Church in 1822. His *Doctrine of the Eucharist during the First Three Centuries* caused his appointment as lecturer in Church History at the university of Munich. He represented the University in the Bavarian parliament, and as delegate at the Diet of Frankfurt he voted for the separation of Church and State. In 1861 he attacked in his lectures the Pope's temporal power. In 1869 and 1870 he opposed the dogma of papal infallibility. He was excommunicated by the Archbishop of Munich, and three months later was appointed rector of the university. In 1873 he became rector of the Royal Academy of Science. Among his principal works are *The Origin of Christianity*, a *Sketch of Luther, Christianity and the Church*, and *Papal Legends of the Middle Ages*.

Dollond, JOHN (1706-1761), a famous English optician. His father, who was a silk-worker in Normandy, came to England as a refugee, and

worked at Spitalfields, where the son worked at optics and science in his little shop. Dollond's chief claim to fame was his invention of the achromatic lens, in spite of Newton's belief that it was impossible to avoid the decomposition to rays owing to refraction. He brought about this improvement by employing a double concave of crown glass and a double convex of flint glass, thus making one lens counteract the refraction of the other. By this means telescopes could be made less bulky and more accurate. Dollond's invention gained for him the Copley medal and the membership of the Royal Society. His son Peter and his nephew George and other members of the family carried on his improvements in optical instruments.

Dolmen. [BARROW.]

Dolomite, named after the French geologist Dolomieu, a double carbonate of calcium and magnesium ($\text{CaCO}_3 + \text{MgCO}_3$), the proportion of the two carbonates varying. It occurs in crystals isomorphous with those of calcite (q.v.), and belonging, therefore, to the Rhombohedral system. Being often stained by hydrous iron-oxide and pearly in lustre, it is known as *brown-spar*, *pearl-spar*, or, from its bitter magnesian taste, as *bitter-spar*. It is harder and heavier than calcite. $H = 3.5$ to 4.5 ; sp.gr. = 2.85 to 2.95 . It more frequently occurs in a granular massive condition as a rock. As it is associated with rock-salt, gypsum, and other chemical precipitates from inland waters it would seem to have been sometimes so formed. Sodium carbonate may decompose lime salts and cause precipitation of calcium carbonate with some admixture of magnesium carbonate, or bicarbonate of lime may decompose sulphate of magnesia, and throw down first gypsum and then dolomite. Most beds of dolomite, however, are fissured or "cavernous," and the volume of the fissures just corresponds to the shrinkage of 12 per cent. that would result by replacing half the molecules in a pure limestone by carbonate of magnesium, so that probably ordinary organic limestone (q.v.) has been so changed or "dolomitised" by the action of magnesium chloride in sea-water. Dolomite or magnesian limestone forms a useful building-stone, and has been long quarried in the Permian (q.v.) rocks of England. York Minster and the Houses of Parliament are built of it. It is so abundant in the Triassic rocks of the South Tyrol that this mountain system is often known as "The Dolomites." Dolomite only effervesces very slightly with cold acids.

Dolomite Mountains, a range in the Tyrol and North Italy, having the Piave and Rienz on the E. and the Val Rendena on the W. They get their name from the dolomite (q.v.), of which they are largely composed, and they are both interesting and picturesque, presenting a great variety of peaks. The highest points E. of the Adige are Marmolata, about 11,000 feet, and Antelao, 10,710; on the W. is Cima Tosa, 10,420 feet.

Dolphin, a book name for any of the Delphinidae, a universally distributed family of marine and fluviatile toothed Cetaceans. The True Dolphins

constitute the genus *Delphinus*, in which the jaws, closely set with minute teeth, are produced into a pointed snout or beak. The single blow-hole is crescent-shaped, the pectoral limbs are narrow and pointed, and a dorsal fin is generally present. The genus has the range of the family, and no species exceeds 10 feet in length. The Common Dolphin (*D. delphis*), often misnamed the "Porpoise," is from 6 feet to 8 feet long, greenish black above and white below. They are very active and gregarious, and are often met with at sea gambolling round the bows of ships. They feed on fish, jelly-fish, and crustaceans, and their flesh was formerly considered a delicacy. This species is noted in classic mythology, and is borne as a heraldic charge. [CORYPHENE.] *D. tursio*, the Bottle-nose Dolphin, has the beak less prolonged; *D. albirostris* and *D. leucopleurus*, the White-beaked and White-sided Dolphins, occur in the North Atlantic; *D. sinensis*, from the Chinese seas, is milky-white; and a species from the South Seas (*D. peronii*) has no dorsal fin. [BELUGA, CAAING WHALE, GRAMPUS, NARWHAL, PORPOISE.]

Dom, the collective name of numerous low-caste communities in many parts of India and Kashmir; are mentioned in the Hindu writings, and are by many supposed to be the original stock of the European gipsies, whom they closely resemble in appearance, habits, and speech. *Dom* appears to be the same word as *Rom* (*d* and *r* interchange in many linguistic families), the root of *Romani*, the name by which the gipsies call themselves, and which in their language means "man," though by some writers connected with the Sanskrit *doma* (*domba*), a strolling minstrel. The Doms undoubtedly represent a pre-Aryan, possibly even a pre-Mongolic black element in India, and those of the Kumaon district (Himalayas) are described as having "curly hair inclining to wool and being all extremely black" (Traill, *Asiatic Researches*, vol. xvi. p. 160). But no trace of their primitive language has survived, and even before the gipsy migrations westwards all the Doms had already been Aryanised in speech. Some are found as far east as the Upper Brahmaputra, where the Domes, a fishing tribe of the Sudiya district, Assam, came originally from India.

Domars, a fierce Brahui tribe [BRAHUI] in the Zarghan hills on the Baluch-Afghan frontier, where they had long been the terror of the surrounding populations before the British occupation of the Pishin Valley. They lived solely by rapine, extending their plundering expeditions as far as the Helmand and Arghandab rivers. They are scattered in small groups over the slopes of the hills, whence they descend in winter to the Shál Valley, near Quettah, where they pitch their skin tents. The Domars grow a little corn and vegetables, but at present live chiefly on the produce of their flocks. Although nominal Mussulmans they still practise some primitive rites totally opposed to the teachings of the Koran. They are physically a fine race, rapidly increasing in numbers and wealth since the establishment of orderly government in Baluchistán (Bellew, *Indus to Tigris*).

Dombrowski, JAN HENRYK (1755-1818), a Polish general who did great service in the wars of Napoleon. He supported Kosciuszko's rising in 1794, and when the Russians took Warsaw Dombrowski was treated with distinction by Suwarow, who gave him free passage into Germany. In 1796 he entered the French service, and fought well at the head of the Polish legion in the Italian campaigns 1796-1801. He took part in the Russian campaign of 1812, and in 1813 distinguished himself at Leipzig. After the fall of Napoleon he went to Poland, and Alexander I. of Russia made him a Polish senator. He wrote a *History of the Polish Legion in Italy* (2 vols.).

Domenichino (Domenico Zampieri) (1581-1641), a painter, the last representative of the great Italian school. He was of the Lombard school and born at Bologna. He studied first under the Flemish Denis Calvaert, and then under Annibal Caracci, after which he went to Rome and was appointed painter to Gregory XV. He was much persecuted by rivals, who are said to have eventually poisoned him. In his early days his fellow-students called him "The Ox" on account of his steady plodding. He was a good colourist, and his faces are in keeping with the characters they represent, but his drapery is heavy and ungraceful. Among his chief works are *Communion of St. Jerome*, *History of Apollo*, *Martyrdom of St. Agnes*, *Triumph of David*, and *Adonis Killed by the Boar*. He had also much merit as a sculptor and modeller.

Domesday Book, the name of the record (strictly speaking, of part only, *see* below) of the great survey of England for purposes of taxation undertaken by William the Conqueror with the consent of the Witan in 1084. Commissioners, who were men of high rank, were sent out to inquire as to every estate, who had held it in the reign of Edward the Confessor; who held it at the time of the inquiry; its value at both dates, whether that value could be raised, and the title by which it was held. Careful inquiry was to be made as to the possibility of imposing increased taxation. Similar surveys had been made before in connection with the Danegeld, with which this was also ostensibly connected, but the minuteness of the investigation made the Domesday survey very unpopular. The evidence was taken in the Hundred Court. The assessment is either by the hide or the carucate (q.v.), and the record contains little direct reference to the Conquest, though indirectly there is evidence of much confiscation. The inquiry was finished in the summer of 1086. The evidence was taken on oath in the Hundred Courts. The name (Day of Judgment) said in mediæval times to have been given from the strictness of the inquiry more probably refers to the decisions of the Commissioners on closing their Courts. The survey covers all England, except the four northern counties and part of Lancashire. The results are preserved in (1) *The Exchequer Domesday* or *Liber de Wintonia*, properly called Domesday Book, of which vol. i. gives concisely the survey of thirty counties, and vol. ii. longer reports of Essex, Norfolk, and Suffolk. (2) *The*

Exon Domesday, in the care of the chapter of Exeter cathedral, which contains detailed accounts of Wilts, Dorset, Devon, and Cornwall. (3) *The Inquisitio Eliensis*, treating of the possessions of the great Abbey of Ely. Mr. Freeman thought that vol. i. of the *Liber de Wintonia* was an abridgement of the record given in more detail in the other volumes mentioned; but this is disputed as regards the *Exon Domesday* at any rate. Domesday Book was reprinted by the Record Commission 1783-1810, and in facsimile in 1864-65.

Domestic Economy. Economy (*oikonomia*) in Greek originally meant "the management of the resources of a household." "Political Economy" being used to denote the management of those of a state, the original term obtained a distinctive if redundant prefix. As used in English elementary education, in which it is a recognised "specific subject" for girls, it includes the preparation, nutritive value and functions of food, with some elementary knowledge of cooking, sanitary rules as to cleansing and ventilation of dwellings and sick rooms, and elementary rules of health. (*See* Annual Report of the Committee of Council on Education.)

Domicile, the lawful home of anyone, or the place which the law infers as such from attendant circumstances, as the keeping of a wife or family. In the case of infants and married women their domicile is that of their parents or husband. The domicile of a person is often an important factor in legal and matrimonial and other proceedings, as it determines all his personal capacities and incapacities. Thus the question whether one can contract a legal marriage with another is regulated not by the law of the country wherein the ceremony may have taken place but by the law of his domicile; so, the legitimacy and majority of an infant (excepting his capacity of inheriting real estate) is dependent on the law of the parents' domicile, and the devolution of personal estate is regulated not by the law of the country where he may happen to die, nor by the locale of the property, but by the law of domicile. Formerly a will of personal estate was required to be made according to the formalities prescribed by the law of the country where the testator was domiciled at the time of death, but this was abolished as regards all wills made after August, 1861, and it is now sufficient if a will made out of the United Kingdom by a British subject is made according to the formalities prescribed by the law of the place where it was made, or by the law of his domicile at the time, or by the law of his domicile of origin or birth. As regards bankruptcy, a debtor must be domiciled in England or (within a year from the date of petition) must have had his residence or place of business in England. A domicile may be either original or acquired. The original domicile is that of the parents of the person at the time of his birth, and usually agrees with his nationality. The acquisition of a new domicile is only complete when the former domicile is completely abandoned, and an actual removal is made to the acquired domicile.

Dominant, in *Music*, the fifth tone of the scale.

Dominica, is one of the largest of the Leeward group of the West Indian Islands, lying to the south in lat. $15^{\circ} 20'$ to $15^{\circ} 45'$ N., and long. $61^{\circ} 13'$ to $61^{\circ} 30'$ W., halfway between Martinique and Guadalupe. It has an area of 291 square miles, and a population of about 29,500, chiefly negro, with a few whites, and some Carib Indians who occupy a reservation, but are being gradually absorbed by the negroes. The Caribs are a quiet folk, living chiefly upon fish, fruit, and vegetables. About half of the island consists of wooded mountains intersected by deep glens, rising to an extreme height of 6,234 feet, while a narrow strip along the coast is cultivated and produces sugar, cocoa, and fruit. Some timber is exported, and the fisheries are extensive. The interior parts of the island are still unexplored. The climate is agreeable, cool and even chilly in the mountains but sultry on the coast, where there is an average temperature of 89° Fahrenheit. There is much rain, the yearly fall amounting to 83 inches. Hot sulphur springs, a boiling lake in the south of the island, the scene of an eruption of ashes in 1880, testify to the volcanic origin of Dominica. Roseau, a port on the west coast, is the capital. The island is represented upon the Legislative Council of the Leeward Isles Colony, and has also a president, treasury, and a local legislature of its own. Religious equality prevails, and the majority of the people are Roman Catholics. Dominica was discovered in 1493 by Columbus during his second voyage, on Sunday, whence its name. In 1648 the treaty of Aix-la-Chapelle neutralised the isle, which had been contended for by France and England; in 1759 the English captured it, but the French held it again for a short time, till it came finally into English possession in 1814.

Dominical Letter, in the Church Calendar, the letter which marks the Sunday (Lat. *dies dominica*, Lord's day) in any given year. In the calendar of pagan Rome the first eight letters of the alphabet were used to mark successive days, the eighth (or in Roman reckoning, which includes both the terminal members in reckoning from the first of a series, the ninth) being the "nundina," or market-day and day of public business. The Christian Church adopted this notation for the week, reducing the letters used, of course, to seven. As, however, the only use of the letters is to indicate when Sunday will come they have obtained their present name. If the Sunday letter be A, Sunday is January 1; if D, January 4; and so on. Hence, of course, the other Sundays can be found. In leap years there are two Sunday letters, one up to February 29, the next behind in order after that date. The method of finding them is stated in the opening of the Prayer Book. Given the Dominical Letter and certain other data (e.g. the Golden Number) also dealt with there, the chief Church festivals for any given year may easily be discovered. The object of these letters and other data is, in fact, to obviate the necessity of an almanack.

Dominican Republic, called also San Domingo, consists of the eastern part of Haiti, embracing two-thirds of the island, and having an area of 20,587 square miles. The state is administered by a president elected by universal suffrage every four years, assisted by a Congress of 22 members. The Republic was originated in 1843, and then reverted to Spanish authority till 1865, when a revolt re-established the Republic, which, with frequent revolutions, has gone on till now. Owing to the unsettled state of things civilisation is backward, but American influence has tended to develop its resources. In the south and west sugar is cultivated, as are tobacco, coffee, and cocoa, while there are exports of mahogany, dye-wood, and guano. The country also produces gold, quicksilver, iron, and coal, and there is a railway of 72 miles. The chief commerce is with the United States, England, France, and Germany. Education is free and obligatory. Spanish is the prevailing language. The capital is San Domingo.

Dominicans (*Fratres Prædicatorum*, or Preaching Brethren), an order of monks established by St. Dominic, and confirmed by the Pope in 1216. From their original black dress they were known in England as the Black Friars. In 1276 the Corporation of London granted the Dominicans two streets near the Thames in the district still bearing their name. Their vows enjoin absolute poverty.

Dominis, MARCO ANTONIO DE (1566-1624), a somewhat noted ecclesiastical trimmer, was born in the Island of Arbe in Dalmatia. He was educated by the Jesuits, and became a professor of mathematics at Padua, where he wrote a work upon light and drew attention to the decomposition of the rays in the rainbow. He afterwards became Bishop of Segni, and then Archbishop of Spalato, but when a quarrel arose between the Pope and Venice he resigned his office. In 1616 he came to England, where he was well received by James I., who made him Dean of Windsor and Master of the Savoy. The next year he wrote a treatise, *De Republicâ Ecclesiasticâ*, in which he urged that the Pope was not supreme, but only *primus inter pares*. In 1619 he wrote a *History of the Council of Trent*, and in 1620, when his fellow-countryman Gregory XV. became Pope, he expressed a wish to be reconciled to the Holy See. In 1622 he desired to leave England, much to the disgust of the king, who tried to dissuade him and maintain his conversion. Failing in this, the king ordered him to leave in twenty days. At Brussels De Dominis wrote his *Consilium Reditus*, in which he recanted his errors, and then went on to Rome, where the Inquisition unkindly doubted his sincerity and put him in prison, where he died.

Domino, a garment worn by priests in cold weather over the other vestments. The name is now applied to a masquerade dress.

Domitianus, TITUS FLAVIUS (81-96), a Roman Emperor, son of Vespasian, and younger brother of Titus, whom he succeeded. In the early part of his reign he showed much promise and passed good laws, but afterwards he became jealous and cruel.

To curry favour with army and populace he increased the pay of the former, and greatly encouraged gladiatorial games in which he himself took part. He killed and banished wholesale the higher citizens, but was at last stabbed by conspirators after he had condemned his wife Domitia to death.

Don, a courtesy prefix used in Spain, equivalent to the English Esq. (It must be used with the surname only.) In England the name is given, in University slang, to the college authorities.

Don, the ancient Tanais, a river of Russia rising in a small lake in the government of Tula, and flowing south through this and other governments and the district of the Don Cossacks, and falling by several mouths into the Azov after a course of 1,125 miles. A canal unites the upper course with the Volga, and a further union between the two rivers in the lower course is proposed. There are several tributaries, some of them navigable, and the Don is navigable below the junction of the Voronej. The stream is impeded by sand-banks, and the spring floods inundate a good deal of country, rendering it necessary to build many of the neighbouring dwellings upon piles. There is good fishing in the river. Two British rivers—in Yorkshire and Aberdeenshire respectively—bear the same name.

Dona Francisca, a German colony of Brazil, lying between the Sierra do Mar and the coast in the province of Santa Catharina. It is fourteen miles inland from San Francisco, and has an area of 979 square miles. The capital is Joinville.

Donaldson, JOHN WILLIAM, D.D. (1811–1861), an English scholar, was the son of a London merchant. Articled in early life to a solicitor, he went to Trinity College, Cambridge, in 1831, graduating in 1834 as 2nd classic and senior optime. He became Fellow and Tutor of his College, and from 1841–55 he was headmaster of Bury St. Edmund's grammar school. He returned to Cambridge, where he gave tuition till his death. His chief works are *New Cratylus* (1839), *Varronianus* (1844), *The Theatre of the Greeks*, and his Greek and Latin grammars. He attempted a work of theological criticism, *The Book of Jasher*, which brought him into some odium.

Donatello (1386–1465), the nickname of Donatodi Betta Bardi, a noted Italian sculptor, born at Florence, where he was apprenticed to a goldsmith. At fifteen he went to Rome with his friend Brunelleschi, and there they studied, supporting themselves meantime by the exercise of their goldsmith's craft. Donatello had already before leaving Florence carved a wooden crucifix, a St. Mary Magdalen, and a marble St. John, after his return from Rome he carved some marble prophets and an Annunciation. Between 1408–1416 he carved in marble SS. Peter, Mark, and George for the outside of the church of St. Michael. In 1426 he executed a tomb of Pope John XXIII., in 1427 one for Cardinal Brancacci at Naples, and in 1429 one for Bartolommeo Aragazzi. Other noted works are a bronze statue of David, and a large equestrian statue at Padua. His last

works—two bronze pulpits—were finished by others after his death. He combined much of the spirit of ancient sculpture with an originality of his own, and inaugurated a new era in the art.

Donati, GIAMBATTISTA (1826–1873), an Italian astronomer, was born at Pisa. In 1852 he became an assistant in the observatory at Florence, becoming director of it in 1864. In 1858 he discovered the bright comet of 1858 which bears his name. Few who saw that comet will forget its magnificence. Besides having a great share in the building of a fine observatory near Florence, Donati constructed a spectroscope of twenty-five prisms.

Donatists, the name given to a sect of Early Christians in Africa, who refused to acknowledge Cæcilianus as bishop of Carthage because he had been appointed by Felix of Aptunge, whom they called a traitor (q.v.). Donatus (sometimes called "the Great"), who gave his name to the sect, succeeded Majorinus, who was the candidate selected in opposition to Cæcilianus. Constantine declared in favour of Cæcilianus, but the Donatists grew in numbers and power until they began to disagree among themselves and split up into various branches. They were annihilated by the Vandals in the 7th century.

Donatus, ÆLIUS (4th century), a grammarian and rhetorician of Rome, who was the teacher of St. Jerome. He wrote several treatises upon the several parts of grammar, and these were so widely used that "Donat" became a word synonymous with grammar, and is so employed in a French proverb, and in the title of a book written by an English bishop. For his works as issued in the early days of printing letters cut on wooden blocks were first used. Donatus also wrote a commentary upon Terence.

Donauwörth, a town of Bavaria, at the junction of the Wörnitz with the Danube, twenty-five miles north-west of Augsburg. It was once a free Imperial city, but its importance has become almost insignificant. The town is of some historic note, for in 1607 it fell under the ban of the Empire and was punished for insulting the Host; it was twice stormed in the Thirty Years' war; in 1704 Marlborough took a French and Bavarian camp formed near by; and in 1805 Soult there defeated an Austrian army.

Don Benito, a town of Spain, near the left bank of the Guadiana, 69 miles east of Badajoz. The town is in a good fruit and grain country.

Doncaster, a municipal borough and market town of the West Riding of Yorkshire, is on the right bank of the Don, 33 miles south of York. It is a well-built town, with a High Street one mile long, with some fine public buildings, including a guildhall, a corn exchange, wool and cattle markets, and a lately rebuilt parish church with a tower and spire of 170 feet. Doncaster is an important railway junction, and the Great Northern Railway Company has here extensive locomotive and carriage works. There are good waterworks. The chief manufactures are iron and brass wares, agricultural machines, sacking, and

linen. The town is noted in the racing-world, the well-known St. Leger having been instituted in 1776. The racecourse is a mile south of the town, and the road to it is bordered by fine old elms. The country round is beautiful though flat, and there is an important cattle market, and a good trade in agricultural produce. An important Roman station on the road from York to Lincoln occupied the same site, and many Roman remains have been found in the neighbourhood, including a votive altar, urns, coins, and the like. There was also here a palace of the Saxon Kings of Northumbria, and the Danes often ravaged the district. In the neighbourhood are the ruins of Conisborough Castle, mentioned in *Ivanhoe*. Pop. (1901), 28,924.

Donegal. 1. An Irish county on the sea-coast in the province of Ulster, having the Atlantic Ocean on the north and west. It has a length of 84 miles with a greatest breadth of 41 miles, and its area is 1,870 square miles, while the bold and broken coast is 166 miles in extent, and is studded with islands large and small. Tory Island, at the entrance of Lough Swilly, has the remains of seven churches, two stone crosses, and a round tower, and on an island in Lough Derg is a noted pilgrim resort called St. Patrick's Purgatory. The surface is much diversified by mountains, moors, bogs, lakes, and rivers; the largest river being the Foyle with a north-east course of 16 miles into Loch Foyle, and the largest lake Loch Derg. The greatest height is 2,462 feet. The climate is moist, and at times rough, owing to the prevalence of north and north-west winds. The county produces much granite, and there are quarries of freestone and white marble. The chief industries are fishing, and the manufactures of woollens, worsted, muslin, and kelp. The trade is carried on mostly through Londonderry. Lifford is the county town. The greater proportion of the population is Roman Catholic. The county returns four members to Parliament. The mountain population is said to be descended from the old Irish clans, but the lowlands are peopled by the descendants of those planted there in 1612 by James I. The O'Donells were once princes of Tyrconnel, which comprised part of Donegal, and besides ruins of castles, forts, and religious houses, there are near Lough Swilly the remains of a palace of the North Irish kings, and near Derry is their coronation stone. There are also memorials of St. Columba. Pop. (1901), 173,625.

2. A seaport town of Ireland, in Donegal Bay, on a creek at the mouth of the Eske, in the south of county Donegal, 157 miles north-west of Dublin. The town is in an alluvial plain surrounded on three sides by hills rising into mountains. The district produces corn and butter, and a railway communicates with the city and port of Londonderry. The remains of Donegal Castle are to be seen on the river, and on the shore are the ruins of a fifteenth-century Franciscan monastery. In the neighbourhood are some mineral springs.

Dongarpur, a central Indian town of Rajputana, capital of a protected state 1,000 miles in area of the same name, 340 miles N. of Bombay.

Dongola, New, a town of Nubia on the left

bank of the Nile, above the third cataract, 750 miles S. of Cairo. It was formerly an independent kingdom with a capital, Old Dongola, the ruins of which are 75 miles S.E., on the right bank of the Nile. It was destroyed by Mamelukes in 1820. A good trade in slaves was formerly carried on here, but the Soudanese war crippled it. In the campaign of 1884-85 New Dongola was the base of British operations against the forces of the Mahdi.

Dongolawi, properly the natives of the province of Dongola, Nubia, but in recent times the term has been applied collectively to all the inhabitants of Nubia, and especially to the Nubio-Arab officials in the employment of the Egyptian Government in Eastern Soudan down to the time of the Mahdi's revolt. The Dongolawi proper comprise two distinct elements—the Barabras, a mixed Nubian people representing the ancient Ethiopians, and the Arab immigrants chiefly from Hejaz. During the mediæval times they were the dominant people in the middle Nile Valley till that region was reduced by the Fungii (Funj) Kings of Senaar. After the overthrow of the dynasty of the Shukieh Arabs the Dongolawi again rose to power, and it was by their aid that the Mamelouk refugees from Egypt were able to drive out the Shukichs. This event prepared the way for the conquest of Eastern Soudan by the Egyptians under Mehemet Ali in 1821.

Dongos (MATIMBOS), a dwarfish people of equatorial Africa, north-east of the Tobbi country, and north of the Setté river. Like the Abongos of the Ogoway basin they appear to be a surviving branch of the primitive pigmy element, fragments of which are still met under various names scattered over a vast area in the interior of the continent (Oscar Lenz).

Donizetti, GAETANO (1797-1848), an Italian composer born at Bergamo, where he studied as well as at Bologna. He entered the Austrian military service, and in 1818 his first opera *Enrico de Borgogna* was produced at Venice. In 1822 he produced *Zoraida di Granata*, and left the army. His *Anna Bolena* in 1830 brought him much renown, which was increased by *Lucia di Lammermoor* in 1835. In 1840 he was at Paris and wrote *La Fille du Régiment*, *Lucresia Borgia*, and *La Favorita*. His comic opera *Don Pasquale* was a success, but his later works were failures. His health gave way, he was attacked by paralysis, and returned home to linger and die. Donizetti wrote over 60 operas, and he was a rapid worker, being said to have written some of his operas in the course of a few hours. He followed first Rossini and later Bellini, and his works are marked by their melodiousness and a neglect of orchestral effects.

Don Juan, a dramatic character embodying sensuality and libertinism unchecked by conscience and followed out to the end. He has been described as a southern Faust, of the senses not of the intellect, and portrayed not in poetry but in music. His life is a drama of lawless love. He seeks to seduce the daughter of the Governor of Seville, slays the Governor, penetrates afterwards to his tomb, and gives a banquet to which he invites the stone statue

of the Governor. The statue appears and drags Don Juan away to Hell. According to another version, Don Juan sold himself to the Devil, but repented and died a monk. The story was dramatised early in the 17th century by a monk named Gabriel Tellez. Molière used it (1665) in his *Don Juan ou le Festin de Pierre*, and Shadwell (1676) in his *Libertine*. Mozart's *Don Giovanni* (1787) is also on this theme. Alexander Dumas used it for his *Don Juan de Marana*, and Prosper Mérimée his *Ames du Purgatoire*; and Byron's *Don Juan* lays it in some degree under contribution.

Donkey Engine is the name given to a small subsidiary engine employed for various purposes, such as the feeding of boilers with water or the lifting of weights, etc.

Donne, JOHN (1573-1631), an English poet said by Ben Jonson to be "the first poet in some things of his time," and by Dryden, "the greatest wit though not the greatest poet." Ben Jonson said also that his works would not live as they would not be understood, and this has proved true. Donne was born in London, being related to Sir T. More, his mother being the daughter of John Heywood, and his father of Welsh descent. He was a Catholic in his early days, and after entering at Hart Hall, Oxford, where he became a friend of Sir Henry Wotton, he travelled, and in 1592 he entered at Lincoln's Inn and joined the Church of England. After taking part in Essex's Spanish expedition he became Secretary to the Lord Keeper, Sir T. Egerton. In 1600 he secretly married the daughter of Sir G. More and niece of Sir T. Egerton. For this he was dismissed from his post and imprisoned, but he managed to be released and to get into favour at Court. He entered Anglican orders in 1615, and was appointed Royal chaplain. In 1616 he received the livings of Keynton, Hunts, and of Sevenoaks, Kent. He was appointed reader at Lincoln's Inn, and as a preacher he is greatly extolled by Izaak Walton, who wrote a life of him. In 1621 he was made Dean of St. Paul's, and was buried in the cathedral. His first poem was printed in 1611, being an eulogy on Sir Robert Drury's daughter.

Donnybrook, now almost absorbed in Dublin, but formerly an outlying parish and village. Its fair, which lasted from the time of King John till 1858, gave rise to many fights and became proverbial.

Doo, GEORGE THOMAS (1800-1886), an English line engraver born in Surrey. He engraved for a time in London, and in 1825 went to Paris, where he studied under Suisse. In 1851 he became F.R.S., and an Academician in 1857. He has produced many well-known engravings from Correggio, Raffaele, and others. Among the best are *Nature*, after Lawrence (1830); *Knave Preaching*, after Wilkie; *Heads*, after Lawrence; *Italian Pilgrims in Sight of Rome*, after Eastlake; and his last unfinished work, *Raising of Lazarus*, after Sebastian del Piombo (1864). He also painted in oils, chiefly portraits.

Döppler's Principle. If waves on the sea succeed each other at equal intervals of one second

we know that a stationary boat floating on the water is passed by sixty waves in a minute. If the boat advances towards the direction from which the waves are coming, more than sixty waves will pass it per minute. Thus, if it travels at the rate of the waves themselves, 120 waves will be received in that interval. So also if the boat retreats in the reverse direction, *i.e.* in the same direction as the waves are travelling, we know that fewer waves will manage to pass it per minute. In fact, not one will pass the boat if it travels at the same rate as the wave-motion itself. This principle, applicable to all cases of wave-motion, is known as Döppler's principle, and is of considerable importance. A steam-whistle on a railway-engine emits a certain note when the train is motionless. If the train be approaching the observer, more waves of sound reach his ear per second than in the first case, and the note seems of higher pitch. If the train is receding, the note is of lower pitch. Again, the light from a distant star is composed of various colours. Each of these colours corresponds to a definite number of waves striking the retina of the observer's eye per second. If the star approach the earth, each colour is slightly changed; a slight change of a different nature takes place when the star recedes from the earth; and by noting the discrepancy that occurs in the light from flaming sodium that reaches us from a distant star, we are able to estimate the speed at which the star is changing its distance from our solar system.

Dor, MONT, properly **DORE**, a group of the Auvergne Mountains of France in the Department of Puy de Dôme. The highest point of the group and of Central France is the Puy de Sancy (6,190 feet). The country is of volcanic formation, and is of great renown in France and the neighbouring lands for its waters and as a health resort.

Dorachos, one of the civilised nations of Central America, who, since the Spanish conquest, have almost entirely disappeared, though a small Doracho tribe still survives about lat. 9° N. on the Pacific coast. They were the dominant people in Veraguas, south of Costa Rica, and to them are attributed the inscriptions, tombs, and other monuments scattered over the western districts of the Panama Isthmus. Of the Dorachos themselves nothing is known beyond what can be conjectured from these remains, which represent a civilisation quite distinct from that of the Northern Aztecs and Mayas.

Doran, JOHN, Ph.D. (1807-1878), an English man of letters born in London. He knew French well, and for this reason was chosen in 1823 as a tutor for the foreign travels of G. Murray, afterwards Duke of Athole. He afterwards held other travelling tutorships. He was in later years acting editor of the *Athenæum*, and afterwards editor of *Notes and Queries*. In 1824 his melodrama, *Justice, or, the Venetian Jew*, was produced at the Surrey theatre, and in 1828 he published a *History of Reading*. Among his many other works are *Their Majesties' Servants*, a history of the stage, *A Lady of Last Century*, *Mann and Manners*, *Letters from Sir Horace Mann to Horace Walpole*, and in 1885 was produced posthumously *In and about Drury Lane*.

Dorcas, a woman mentioned in the Acts (ix. 36) as the subject of a miracle worked by St. Peter. From the direction her charity took, societies for making clothing for the poor are known as "Dorcas societies."

Dorchester. 1. A municipal borough, county, and market-town of Dorsetshire, on the Frome, 8 miles N. of Weymouth, and 120 miles from London. It has breweries of ale and beer, and is the centre of a good agricultural and cattle-producing district. The cattle-market is held on Saturday. The Elizabethan grammar school, founded 1579, has been rebuilt and re-organised under a scheme of the Charity Commissioners. There is a county museum containing some good geological specimens, and a fine piece of Roman pavement. Dorchester is the head of the 39th Regimental District, and has a Royal Horse Artillery barracks. There was here a Roman station consisting of walled town with ditch, and there are the remains of a Roman amphitheatre, 218 feet by 163 feet in area and 30 feet deep, with seats cut in the chalk, capable of holding 30,000 people. There is also a Roman camp with ditch and rampart, and also a large British station with three earthen ramparts. The town was Cromwell's headquarters in 1645, and in 1685 the Bloody Assizes made 292 victims. Pop. (1901), 9,458.

2. A village near Oxford noted for its fine church, and as having been the seat of the Bishops of Merca, and for a curious ridge of gravel which is, or was, to be seen in a field there, as to whose origin several theories have been formed.

Dordogne, a department in S.W. France, has an area of 3,530 square miles, and takes its name from the river which, after a course of 305 miles (185 of which are navigable), unites with the Garonne to form the Gironde. The climate is for the most part mild and healthy, but the soil is poor and hilly, with much forest and underwood, alternated in places by lovely valleys and vine-clad hills. There is little agriculture, but some iron working, and manufactures of paper, woollens, and glass. Wine and brandy, oil, fruit, and fat cattle are produced. The truffles of Périgord are famous. Capital, Périgueux.

Doré, GUSTAVE (1833-1883), a French engraver and painter, born at Strasburg. He came to Paris when twelve years old, and when fifteen was exhibiting pen and ink landscapes in the Salon. In 1848 he was engaged on illustrated journals, and in 1854 produced his first continuous work—a set of illustrations to Rabelais. In 1856 appeared his illustrations to *The Wandering Jew* and to the *Contes Drolatiques* of Balzac. In each of these he showed his great powers in producing effects weird, horrible, and grotesque. Who can forget the scene of the Jew taking off his boots at the Last Day, or the view of a besieged castle in the *Contes Drolatiques*, where everyone has his spear or sword in somebody else, and the eye by going from weapon to weapon is led throughout the picture? His *Inferno* in 1861 exhibits the same power of depicting horrible scenes. Then followed the *Contes* of Perrault, *Don Quixote*, *Purgatorio*, *Paradiso*, *Paradise Lost*, the *Idylls of the King*, *La Fontaine's*

Fables; but his later works show a great falling-off, the natural result of over-production. Doré was also a painter, but in this department of art he did not excel, though his work is not without its admirers. *Christ Leaving the Prætorium*, and the *Entry into Jerusalem* are well known, and the Doré Gallery in London was well visited. He also made some attempts in sculpture.

Doria, ANDREA (1466-1560), a Genoese admiral, born of a noble family that had fallen into decay. Andrea was born at Oneglia, and at the age of nineteen entered the Pope's body-guard. On the accession of Alexander VI. he took service with the Duke of Urbino, and then with Alfonso of Naples, and then went to the Holy Land till the Borgia tyranny should be overpast. He then joined the Prince of Sinigaglia against the Spaniards, who were overrunning Italy. In 1503 he retired to Genoa and commanded the galleys of the republic against the Turkish corsairs, and greatly distinguished himself. In 1522 a revolution in the imperial interest to which he was opposed drove him forth, and he offered his services to the King of France, gaining many victories over the forces of the Emperor. In 1529, for some unknown reason, he quitted Francis I. and offered himself to Charles V., who received him gladly, and in his service Doria inflicted many defeats upon his old comrades the French. He was welcomed at Genoa, where he became head of the State and established a form of government of aristocratic tendencies. The Emperor bestowed upon him the Order of the Golden Fleece, and made him Prince of Melfi. The war against the Corsairs almost became a duel between Doria and Barbarossa, the Turkish leader. In 1531 Doria made an attack upon Barbarossa's stronghold on the Barbary coast, but did not accomplish much, though the next year he took Patras and Coron from the Turks. In 1535 he went with Charles V. to Tunis and destroyed Barbarossa's fleet. The latter, as commanding-in-chief the Turkish navy, then harassed the Mediterranean islands, and in 1538 offered battle to the Imperial, Papal, and Venetian fleet, and overcame Doria, who was again worsted by him in 1541, and by his pupil in 1560. Though beloved by the people and a favourite councillor of Charles V. and his son Philip, Doria incurred some odium in his later years for the savage vengeance he took upon the slayers of his nephew. He died at Genoa without issue.

Dorians, one of the four great divisions of the ancient Greeks (the other three being the Achæans, the Æolians, and the Ionians). They obtained their name from the district of Doris in the centre of Hellas, near Aetolia and Thessalia, and supposed by some to have been their original home. They were noted for their simple, rough, earnest manners and characteristics, as opposed to the more effeminate, polished grace of the Ionians. But these manners chiefly marked those of Sparta and Crete: the Dorians *e.g.* of the Colonies are much more like the Ionians in character.

Doris, one of the best known genera of Nudibranchiate (q.v.) Gastropoda or "Sea-slugs." It is

the type of the family *Dorida*, or the "Sea-lemons." They are always shell-less, and are depressed, flat animals, with a pair of tentacles standing up in front and a clump of gills behind. They creep about over seaweeds and rocks; they occur in all seas from the tropics to the frigid zones; they all live near the shore and rarely occur at a depth of more than twenty-five fathoms.

Dorislans, ISAAC (1595-1649), was born at Alkmaar, in Holland, and in 1627 came to England, where he lectured upon History at Cambridge, and was appointed Judge-Advocate. In the Civil struggle he sided with the Parliamentarians, and in 1649 went to Holland to negotiate an alliance with the States-General, and here he was stabbed by some Royalist conspirators. His body was buried in Westminster Abbey, whence it was removed to St. Margaret's church in 1661.

Dorking, a charmingly-placed town of Surrey at the foot of Box Hill, 24 miles S.W. of London. In the neighbourhood is the estate of Deepdene, where "Anastasius" Hope lived and Disraeli wrote *Omingsby*, and a pretty walk through the estate leads to Leith Hill (960 feet), which commands a view of the Weald and a glimpse of the sea through a gap in the South Downs. There is also a pleasant walk along a ridge of the Downs to Guildford. Many visitors look for the "Markis of Granby" of Pickwickian renown, but in vain. Pop. (1901), 7,670.

Dormer Window, a window in a sloping roof built with a vertical wall of its own.

Dormouse, a name for any of the Myoxidae, a family of arboreal nocturnal mouse-like Rodents (q.v.), from the Palearctic and Ethiopian regions, and distinguished from the rest of the order by the absence of a cecum. The Common Dormouse (*Myoxus avellanarius*), the only British species, but widely distributed in Europe, is about six inches long, of which the rather bushy tail is a little less than a half. It feeds on nuts, acorns, seeds, berries, and the buds of shrubs and trees. In autumn it builds a nest, and, like the rest of the family, undergoes a partial hibernation. The Loir (*M. glis*), a larger species, is confined to the south of Europe, and ranges into Asia. The Romans fattened it for food, and it is still eaten in Italy. The Garden Dormouse, or Lerot (*M. nitela*) is common in Southern and Western Europe. Some authorities have made the African species, in which the tail ends in a pencil of hair, a separate genus, and have split up Myoxus into sub-genera, but the differences are not important and the family is generally considered to have but a single genus.

Dorner, ISAAC AUGUST (1809-1884), a German theologian, born near Tuttlingen, in Würtemberg. After studying philosophy and theology at Tübingen he travelled in England and Holland and filled various chairs till called to Berlin in 1851. He had great influence, and his writings had much to do with forming modern German theology.

Dorpat, a Russian town in Livonia on the Embach, 165 miles S.W. of St. Petersburg. The

town possesses two suburbs, and the river is crossed by a good granite bridge. The Domberg Hill, on the right bank of the river, had a citadel, bishop's palace, and cathedral, but is now occupied by an observatory and a library surrounded by gardens and walks. There are fine botanic gardens. The city is the centre of the Germanising influence, and its population is mostly German. Among the industries are printing, brewing, the making of cigars, tiles, pianos, and there is a trade in wood, corn, and flax. The University, founded in 1632 by Gustavus Adolphus, and refounded in 1802 by Alexander I., is entirely Russian in its influence.

D'Orsay, ALFRED GUILLAUME GABRIEL (1801-1852), was a shining light of fashionable society of his day, and the Admirable Crichton of the early part of the century. The son of General D'Orsay, he was a lieutenant in the Garde du Corps of Louis XVIII., and in this capacity made the acquaintance of Lord and Lady Blessington. He much appreciated the lady's society, and accompanied the pair to Italy and elsewhere till 1827, when he married the Lady Harriet Gardiner, step-daughter of Lady Blessington, the lady being 15 years old. In 1829 Lord Blessington died, and D'Orsay quitted his wife to live with Lady Blessington in London, where for 20 years the pair retained great social influence. D'Orsay was a friend of Louis Napoleon, and just before his death was appointed by the latter Director of Fine Arts in Paris.

Dorsetshire, a southern English county on the coast of the English Channel, between Hampshire on the E. and Devonshire on the W., with an average breadth of 21 miles and a length of 58 miles, and an area of 627,265 acres. About half is arable, and the greater part of the rest is pasture-land. There are 75 miles of coast, with fine cliffs and headlands, the highest points being Golden Cap (619 feet) and St. Alban's Head (354 feet). Chalk downs stretch along the south coast, and through the middle of the county from E. to W., rising to a greatest height of 934 feet. The principal rivers are the Stour and the Frome. The geological formation of the county is chalk, clay, oolite, lias, weald, and greensand, and some fine fossils of extinct reptiles have been discovered. Purbeck marble, Portland building stone, china clay, and pipeclay are found. The climate is mild, and the upper soil of sand, gravel, clay, and chalk is specially fitted for cattle-breeding and dairy purposes. The short, sweet grass of the Downs supports an excellent breed of sheep, and Dorsetshire cheese, butter, and cattle are renowned. One of the most striking features of the county is the Chesil Bank, a ridge of pebbles 10 miles long uniting the so-called Portland island with the mainland, and enclosing a narrow tidal channel containing decoy ponds, and a noble swannery at Abbotsbury, south of Portland. The meeting of the tides causes a dangerous current called the Race. Portland is a well-known convict station, harbour of refuge, and coaling station; it is well fortified, and the harbour is protected by a breakwater. There are in the county manufactures of linen, silk, woollens, and other goods, and ale and cider are brewed. The county

returns four members to Parliament. The London and South Western, the Great Western, and the Midland railways serve the county. There are many British and Roman remains, among the former being a long-chambered barrow with intricate passages. Of later ruins perhaps the most interesting is Corfe Castle. Alfred fought the Danes off the coast here in 876. Pop. (1901), 202,962.

Dorsibranchiata, a synonym of Errantia (q.v.), a name for that group of worms in which the gills are borne as a series of tufts along the back.

Dorstenia, a genus including thirty-six species of curious herbaceous plants, natives of tropical America, related to the figs. They have radical leaves and a scape terminating in a common receptacle, which is often quadrangular and on which are the numerous achlamydeous flowers. The ovary is one-chambered and one-seeded, and has a bifid stigma. After the fertilisation of the flowers the receptacle becomes slightly succulent, though less so than that of the figs. It thus resembles a fig opened out into a plate-like body.

Dort, or DORDRECHT, a town of South Holland, 10 miles S. of Rotterdam, upon an island in the Maas, which was formed by the famous inundation of 1421, which swallowed up 70 villages and 100,000 people. It is one of the oldest and once richest trading towns of the Netherlands, and was founded in 1013. Its Gothic cathedral and its town-hall date from the 14th century. It is intersected by canals, and its harbour admits large East Indianmen and the huge wood-rafts of the Rhine. There are ship-yards, corn and saw-mills, and there are industries in oil, sugar, ironware, and machinery. In 1572 the first assembly of the States took place here, and in 1618 the Synod of Dort approved the doctrines of Calvinism. The De Witts, Ary Scheffer, and Cuyper were born here, the last of whom constantly introduces the features of Dort into his paintings.

Dortmund, the chief town of Westphalia, near the Ernscher, 72 miles N.E. of Cologne. It was formerly a free Hanse town, and was ceded to Prussia in 1815. The prosperity of the town has been much increased by the neighbourhood of coal-mines, and it is the head of the mining district and the centre of a railway system. Among its industries are iron and steel and machinery works, and very many breweries. The town has an interesting early history, and there are several old churches. An old linden marks the site of the Vehmgericht. The demolition of the walls in 1863 has much modernised the town.

Dory, any fish of the Acanthopterygian family Cyttidae, with two genera (*Zeus* and *Cyttus*), from the seas of the temperate zones. The body is elevated and compressed, with minute scales or naked, and in the first-named genus there are bony plates at the base of the dorsal and anal fins and along the abdomen. *Zeus* has six species, all excellent food-fish. The best known is *Z. faber*, the John Dory, from the Mediterranean and the coasts of Western Europe, and occasionally found on the

British coast. It is usually of a metallic yellow, or brownish olive, with a black spot on each side, said to be the marks left by St. Peter's fingers when he took the tribute-money from its mouth. The membrane between the spines of the first part of the dorsal fin is produced into long filaments. It is very voracious, and a specimen 22 inches long is recorded by Couch.

Doseh, a religious ceremony formerly practised in Egypt by the Dervishes. The participants in the spectacle lay down on their faces side by side, and the sheikh then rode over the bodies. The late Khedive Tewfik abolished the ceremony.

Dostoieffsky, FEODOR MIKHAILOVITCH (1818-1881), a Russian author, born at Moscow. He at first entered the army, but abandoned it for literature. He wrote a work, *Poor People*, in 1846, but being concerned in plots in 1849, he was condemned to the mines of Siberia for twelve years. He was allowed to return to St. Petersburg in 1856, and in 1861 he wrote an account of prison life. In 1868 he published *Crime and Punishment*, which was well received, and has been translated, but other works of his have not made much mark.

Dotterel (*Eudromias morinellus*), a bird of the Plover family visiting England, chiefly the eastern counties, in the summer, sometimes breeding in the northern parts of Britain. Its length is about 9½ inches; the summer plumage brownish-grey above, ferruginous beneath, with some white on the head and breast, and a black patch on the belly. In winter the colour is mostly blackish-ash, with a white patch on the breast. These birds, which are prized for the table, have an undeserved reputation for stupidity. The Ring Dotterel (*Agallitis hiaticula*), common on the British coasts all the year round, is said to act as sentinel to some of its allies.

Douay (the Roman *Duacum*) is in the department of the Nord, on the river Scarpe, 20 miles S. of Lille, and is one of the chief military towns of France, strongly fortified, and possessing arsenal, cannon foundry, and school of artillery. It has good churches, hôtel de ville, library, museum, hospital, and artillery barracks. The chief industries are the manufacture of lace, cotton, oil, soap, ironware, and machinery. But the chief interest to Englishmen of Douay is centred in the fact that it was the centre of English Catholicism after the Reformation. Cardinal Allen founded an English college here in 1568, and it was from here that most of the missionary priests were sent to England. The college sent a colony to Rheims in 1578-93. The Douay Bible was printed at both places—the New Testament at Rheims in 1582, and the Old Testament at Douay in 1610. Many other important works were printed here. The college buildings are now the artillery barracks. Among the Douay students expelled from France during the First Revolution was Lingard the historian. Ushaw College, near Durham, is an offshoot of Douay. There were also Scottish, Irish, Franciscan, and Benedictine colleges. In early times possession of Douay was disputed between French and Flemish. Passing

later to Spain, it was taken by Louis XIV. in 1667. Marlborough took it in 1710, but it was reoccupied by France, and secured to her by the treaty of Utrecht.

Double, the apparitional soul of an absent person, a wraith. Sometimes its appearance is a case of bilocation (q.v.), at others it is said to portend the death of the person seen. To see one's own double is thought by some to be a sure sign of approaching death.

Double Flowers differ considerably in structural origin. Most commonly they consist in an increased number of petals with entire loss of stamens and carpels, as in roses, bachelors' buttons, ranunculi, etc. Sometimes the carpels only or the stamens only are petaloid, or there may be, as in double stocks, an increased number of petals by chorisis (q.v.) without any change of stamens or carpels. Among gamopetalous flowers there may be a petaloid calyx, as is sometimes the case in Primula; or there may be a second corolla or "cata-corolla," as an outgrowth outside the normal one, as often occurs in Campanula; or both calyx and corolla may be repeated once or oftener one inside the other, "hose in hose." The term double flower is less accurately applied to the inflorescences of certain Compositæ in which either all the tubular disc florets become ligulate like those of the ray, as in the Dahlia; or, as in "quilled" chrysanthemums, their tubes are elongated; or, as in the "dragon" varieties, they are irregularly prolonged in distinct petalline segments. The so-called double Poinsettia (q.v.) has merely some extra coloured bracts below the inconspicuous inflorescences. Though double flowers do occur in a wild state they are far more common among cultivated plants, being produced by some check to vegetation, either by starvation; by plethora, i.e. an excess of food which the plant cannot assimilate; or by sterility, the removal or non-development of the sexual organs. Double stocks are raised from plants weakened by starvation—i.e. drought, which produce short pods with few seeds, only the seeds from the lower part of the pods being sown. The tendency to form double flowers becomes hereditary.

Doubling the Cube, an ancient mathematical problem discussed by Greek geometers. It practically means finding an expression for the length of the side of a cube that shall have twice the volume of another cube whose side is given. The solution of the problem cannot be obtained by use of straight lines and circles only, but may be effected by use of the conic sections or other special curves.

Doubs, a department of eastern France upon the Swiss and Alsatian frontiers, with an area of 2,010 square miles. The chief rivers are the Doubs (270 miles) and the Ognon (120 miles), both tributaries of the Saône. The country is hilly, and in the S.E. the Jura Mountains rise to a height of 4,600 feet. The climate is rigorous and moist, and though agriculture is backward, it is advancing, lands being drained and reclaimed, and three-quarters being now under cultivation, or planted with

timber. The chief products are wheat, oats, vine, and figs. There is much pasturage and making of butter and cheese, and rearing of horses and goats. There are iron mines and manufactures of iron-ware, clocks, glass, paper, and pottery. The capital is Besançon.

Douce, FRANCIS (1757-1834), an English antiquary, born in London. He was keeper of the MSS. in the British Museum. His books, MSS., prints, and coins he left to the Bodleian Library, his letters and commonplace books to the British Museum. Among his works are *Illustrations of Shakespeare* and *The Dance of Death*; he contributed to antiquarian and other magazines, and aided in editing several works.

Douglas, a town on the east coast of the Isle of Man, and the capital of the island, derives its name from Dhoo (black) and Glas (grey), the names of two small rivers that fall into the sea there. It is a pretty town, lying in a beautiful bay. The approach to Douglas upon a fine summer's day, when the green amphitheatre of the hills opens to view behind the blue waters of the bay, is said to be equalled only by that of Naples. The charms of the island, added to its nearness to the English coast—75 miles from Liverpool, 46 from Barrow—and its bathing facilities, have made it one of the favourite holiday resorts. There is a landing stage, together with a new pier and break-water, and a new street and promenade have been lately constructed. The new Douglas of hotels and lodging houses has almost swallowed up the little old town. Castle Mona—once the abode of the Dukes of Athole, lords of Man—is now an imposing hotel, strikingly situated upon the cliff and surrounded by fine grounds. A striking feature in the bay is the Tower of Refuge, built upon a dangerous rock in the bay by Sir William Hillary, founder of the National Lifeboat Institution, and intended to be a refuge for shipwrecked sailors. There is a daily service of steamers to Douglas in the summer, and there are many pleasant excursions to be made in the neighbourhood—to Laxey, with its huge water-wheel, across the island to Peel, to Kirk Braddan churchyard, with its old Runic tombstones and the monuments of the Dukes of Athole, to the ruins of St. Bridget's convent; while a bay a little to the north abounds in beautiful sea anemones.

Douglas, the name of one of the most ancient Scottish families, whose border life gave them experience in war and made them formidable. Some of the most noted are William, the companion of Wallace, "good" Sir James who fought at Bannockburn and carried the heart of Bruce to the East, and Archibald, Regent of Scotland, killed at Halidon Hill, William the 1st Earl, who fought at Poitiers, James the 2nd Earl, killed at Otterburn, 1388. The later Douglasses were a younger branch of Angus, and were called Red Douglasses by way of distinction from the older branch of Black Douglasses. Lord Darnley's mother was the great granddaughter of Archibald Bell-the-Cat. The Dukedom of Douglas, founded in 1703, became extinct in 1761. The line of Angus is now represented by the houses of Hamilton and Home.

Douglas, DAVID (1798-1834), a Scottish botanist. While working in the Botanical Gardens at Glasgow he attracted notice, and in 1823 became collector to the Horticultural Society of London. He went to the United States, explored the Columbia river and California, travelled from Vancouver to Hudson's Bay making collections, and gave his name to the *Abies Douglasii*. Finally he lost his life in the Sandwich Isles by falling accidentally into a wild-beast trap and being killed by an animal already entrapped.

Douglas, GAWIN (1474-1522), son of Earl Archibald of Angus (Bell-the-Cat), was a Scottish poet, born at Brechin. He was educated at home and at Paris and took orders, but did not meet with the preference that his prominent position might have led him to look for. He was active at politics and was present at Flodden, where his two brothers and 200 of the Douglasses fell. It was at this period that he wrote most of his poems. Later he was made Bishop of Dunkeld, but the intrigues of the Hamiltons against the Douglasses turning in favour of the former, he was forced into exile, and finally died in London of the plague. Among his poems are *The Palace of Honour*, an allegory of the virtuous man, and *King Hart*, an allegory of the human heart, not published till 1788. He is also famous for having translated the *Æneid*, with prologues to the different books, the first poetical translation of classics into English.

Douglas, SIR HOWARD, Bart., K.C.B. (1776-1861), the son of Admiral Sir Charles Douglas, was an English general and writer upon military subjects. He served in the Peninsular war, and was Governor of New Brunswick (1823-29) and Lord High Commissioner of the Ionian Islands (1835-40). He became general in 1851. Among his works are an *Essay on Military Bridges* (1816), a treatise on *Naval Gunnery* (1819), *Observations on Carnot's System of Fortification*, a treatise on *The Value of the British Provinces in North America*, and a work on *Naval Evolutions* (1832).

Douglas, JOHN (1721-1807), Bishop of Salisbury, was the son of a shopkeeper in Fifeshire. Educated at Dunbar and Oxford, he took orders, and was a military chaplain in Flanders, being present in 1745 at the battle of Fontenoy. He was made bishop in 1791. Most of his writings were of a controversial nature, among them being a *Defence of Milton against the Charge of Plagiarism* (1750) and *Letters on the Criterion of Miracles*, against Hume (1754). He also edited Captain Cook's journals. He was a member of the Royal Society, and Vice-President of the Society of Antiquaries.

Douglas, STEPHEN ARNOLD (1813-1861), an American statesman born at Vermont. He became attorney-general of the state of Illinois, and in 1845 was elected a member of the United States House of Representatives. From 1847 till his death he was in the Senate, and in 1860 he was a candidate for the Presidency which Mr. Lincoln gained. Mr. Douglas as a politician was "a Free-soiler," i.e. in favour of each new state or territory

settling for itself whether it should admit slavery or not. He was also in favour of the annexation of Texas and the enlargement of the borders of the United States generally.

Douglass, FREDERICK (1817-1895) was born a slave in Maryland, his father being a white man. He was reared a slave, and in 1832 was sold to a Baltimore ship-builder. In 1838 he escaped, and having already educated himself, he was chosen to lecture by the Anti-Slavery Society. He lectured in England as well as in America. In 1847 he started a newspaper, and in 1870 the *New National Era*. In 1871 he was Secretary of the Commission to San Domingo, and in 1872 became a Presidential elector. In 1877 he was made Marshal for the district of Columbia, and afterwards Commissioner for Deeds in the district. His *Autobiography* was published in 1845, and re-published with some changes and additions in 1855.

Doulton, SIR HENRY (b. 1820), was born at Lambeth, and at an early age entered into the pottery works there, studying the business practically from the bottom. In 1846 he turned his attention to the construction of stoneware drain-pipes, and two years later established a drain-pipe factory at Dudley, now the most important in England. But his great achievement was developing the manufacture of art pottery, by which he has made Doulton ware famous throughout the world. He was made Chevalier of the Legion of Honour in 1878, and received the Albert Medal in 1885. He died in 1897.

Douro (the Roman *Iurios*), a river of Spain and Portugal, rising in the Pico d'Urbion in the Spanish province of Soria, flowing S.E. and S. past the town of Soria, through the provinces of Burgos, Valladolid, and Zamora, then S.W. and forming the frontier between Spain and Portugal, and falling—after a course of 400 miles, in which it receives several tributaries—into the Atlantic a little below Oporto. Running for much of its course in a deep narrow valley, it is rocky and has rapids and eddies, but is navigable for more than 80 miles from the mouth. It has plenty of fish.

Dove. [PIGEON, RING-DOVE, TURTLE-DOVE.]

Dove, an English river on the borders of Derbyshire and Staffordshire, 4 miles S.W. of Buxton, falls into the Trent a little below Burton after a course of 45 miles. It is famed, first for the beautiful Dovedale—a glen 3 miles in length—through which it flows, and where is some of the most charming scenery in England, and, secondly, for its association with Izaak Walton and Charles Cotton, who fished here and have endeared the name to anglers for evermore.

Dove, HEINRICH WILHELM (1803-1879), a German man of science, was born at Liegnitz in Silesia, and studied at Breslau and Berlin, where he graduated doctor in 1826. He became a professor at Berlin in 1829, and was afterwards made member of the Academy of Sciences and Director of Prussian Observatories. He threw much light upon the laws of climate and meteorological

phenomena. Among his works are *Meteorological Researches* (1837), *The Distribution of Heat on the Earth's Surface* (1852), *Law of Storms* (1857). He also wrote upon Electricity, the Theory of Colours, and many kindred subjects.

Dovekie. [ROTCHIE.]

Dover (the Roman *Portus Dubris*). 1. A parliamentary (one member) and municipal borough on the coast of East Kent, a Cinque Port, and the principal port for intercourse with the Continent. It is 86 miles from London, is strongly fortified, and is the chief station of the South-Eastern military district. Everyone is familiar—at least by description—with its white cliffs, and is ready to admit the fitness of the old epithet applied to it: "Clavis et repagulum regni." The Admiralty Pier forms a harbour of refuge, and there are three landing-places, and a fine breakwater. The Castle, which has Saxon and Norman portions, is garrisoned, and there are other forts, batteries, and barracks upon the heights. The Roman *pharos* still exists. Among its public buildings are the town hall, the museum, and the hospital. There is some ship-building, and sail, rope, and paper making, and the Dover pilots are an important body of men. The Lord Warden of the Cinque Ports has his residence near, and three cables put the town in communication with France. Dover has naturally played an important part throughout English history. Pop. (1901), 41,782.

2. The capital of Delaware state, U.S., is at the mouth of Jones's Creek, which falls into Delaware Bay, and is 48 miles S. of Wilmington. Leather, cotton, and wool are manufactured, and there is a good deal of fruit-canning.

Dover, STRAITS OF, a narrow neck of water lying between Dover and Calais, and called by the French *Pas de Calais*, joining the North Sea and the English Channel, and having a depth of 6 to 29 fathoms and a width of 18 to 25 miles. The shallowness of the passage and the nature of the opposite coasts seem to prove that the Straits are of comparatively recent geological formation.

Dover's Powder, the pulvis ipecacuanhæ compositus of the Pharmacopœia, contains ipecacuanha one part, opium one part, and sulphate of potash eight parts. Dose, 5 to 10 grains for an adult. It is largely used to promote perspiration at the commencement of febrile attacks, also as a sedative expectorant and as a narcotic.

Dove's Law of rotation of winds is that in north latitudes the tendency of the wind is to veer round in the same way as the sun's diurnal motion—from north, through north-east, east, south-east, and south, back to north through the other points of the compass. The contrary direction prevails in south latitudes.

Dovrefeld, a group of Norwegian mountains forming the central part of the Scandinavian system, and stretching N.E. from lat. 62° to the rise of the Kôlen Mountains, lat. 63°, and rising to the height of 7,620 feet in Snehaetta. Their chief components are gneiss and mica schist.

Dow, GERARD (1618-1675), a great painter of

the Dutch school, born at Leyden. He studied under Rembrandt, and while often showing the same vigour and transparency of colouring as his master, he shows the same power of chiaroscuro, and has a fineness and delicacy all his own. A critic, Waagen, has said that his pictures are "nature seen in a camera obscura." His known works are very many, and his favourite subjects were taken from family life.

Dowden, EDWARD (1843), born at Cork, was educated at Queen's College, Cork, and at Trinity College, Dublin. In 1867 he became Professor of Oratory in Dublin University, and afterwards Professor of English Literature. He has written many magazine articles, and is especially noted as a Shakespearean scholar. His *Shakespeare: a Study of his Mind and Art* (1875), and his *Shakespeare Primer* (1877), are well known. He published *Studies in Literature* (1878), a work on Southey in *English Men of Letters* (1879), and a *Life of Shelley* (1888), *Robert Browning* (1903).

Dower is that part of the husband's lands and tenements to which the wife is entitled for her life upon the husband's death. It is regulated by the statute 3 and 4 William IV., chap. 105, which abolished certain kinds of dower, and for the first time gave dower out of equitable estates. It also simplified the way in which dower could be barred or defeated. Except in cases of special custom, as Gavelkind (q.v.), the wife is entitled to one-third of the income of the husband's lands and tenements for her life.

Dowlas, a strong coarse kind of linen formerly in use in England, when it was manufactured in Yorkshire and the Lowlands of Scotland.

Down, a coast county in the S.E. of the province of Ulster, containing 612,399 acres, and having a length of 50 miles by 13 miles broad, with a coastline of 67 miles. The coast is indented by Belfast and Strangford Loughs and Dundrum and Carlingford Bays. The chief rivers are the Upper Bann and the Lagan, while the Newry Canal and the Ulster Canal give a good water communication. The south is mountainous, and the Mountains of Mourne rise to a height of 2,796 feet. The rest of the country is diversified by hill, dale, and plain, and is fertile. The chief crops are corn, potatoes, flax, and turnips, while pigs, horses, and cattle are reared. Much fine linen and muslin are made at the homes of the people, and there are manufactures of hosiery, thread, leather, woollens, and salt. These are largely exported, as are also corn, butter, pork, and hides. The bulk of the population is Protestant, a large proportion being Presbyterian. The principal towns are Kirkpatrick and Newry. There are many ancient remains of round towers, castles and abbeys, and cairns. Down returns four members to Parliament and Newry one.

Downs, like *dunes*, a name given to the hills and mounds of sand to be found on many coasts, generally shifting, but in some cases gradually rendered firm and coherent by the plantation of trees and grasses. Such dunes are to be found on the coasts of Holland and Belgium, the northern

coasts of France, the coast at the mouth of the Mersey, and the great Belgian waste called La Campine, or Kempenland, which is now far from the sea. 2. To grassy rounded hills such as the North Downs, which pass through mid-Surrey and into Kent to Dover, and the South Downs, which extend from Hampshire to the sea at Beachy Head. The Downs rise to a greatest height of about 900 feet and are for the most part covered with grass, which affords excellent grazing and rears a noted breed of sheep. 3. A roadstead lying between Ramsgate and Deal, from the North to the South Foreland, sheltered by the natural breakwater of the Goodwin Sands, and affording a safe anchorage except against south winds.

Doxology, a hymn of praise to God, specially used in the Church of England to denote the *Gloria Patri*, or the *Gloria in Excelsis Deo*, or some metrical version of these.

Doyle, SIR A. CONAN (b. 1859), studied medicine, and later took to literature. Among his better known works are *Micah Clarke*, *The White Company*, *The Adventures of Sherlock Holmes*, *The Great Boer War*, etc. He was knighted in 1902.

Doyle, SIR FRANCIS (1810-1888), an English poet, born near Tadcaster and educated at Eton and Christ Church, where he took a first-class in classics in 1831. He succeeded to the baronetcy in 1839 and held a post in the Customs. From 1867-77 he was Professor of Poetry at Oxford, and Fellow of All Souls. In prose, besides *Two Series of Oxford Lectures* he published an interesting book, *Reminiscences and Opinions*, from 1813-85. Some of his best known poems are *Return of the Guards*, *The Birkenhead*, *The Red Thread of Honour*.

Doyle, RICHARD (1826-1883), an eminent caricaturist and illustrator, born in London, and the son of John Doyle, better known as H. B. For some years Richard Doyle contributed to *Punch*, for which he designed the cover, but left it in 1850 in consequence of its attitude upon the Catholic question. He illustrated Thackeray's *Newcomes* and *Rebecca and Rowena*, Ruskin's *King of the Golden River*, Hughes's *Scouring of the White Horse*, and did the *Sketches of Modern Society*, which were so conspicuous a feature of the earlier days of the *Cornhill Magazine*.

Dosy, REINHART (1820-1883), a Dutch Orientalist and historian, who, besides being learned in the Semitic tongues, was master of most European languages. He wrote mostly in Dutch or French. Among his chief works are *Histoire des Mamelukes d'Espagne*, *Het Islamisme*, a *Detailed Dictionary of the Names of Arab Dress*, and particularly *Catalogus Codicum Orientalium at Leyden*.

Drachenfels, the Dragon's Rock, a noted height of 1,650 feet in the Siebengebirge range of mountains, on the right bank of the Rhine, near Bonn. The height is steep and hard to climb, but now a railway leads to the top. On the top are the ruins of a castle, and it was on this rock that the dragon slain by Siegfried used to dwell.

Meredith's *Legend of Cologne* makes a humorous use of the dragon story.

Drachma, an Attic weight, of about 66 grains; the Æginetan drachma weighed about 100 grains; the silver coin of the same name was worth about a franc (i.e. nearly 10d.). It contained six obols. The modern Greek drachma is the equivalent of the franc.

Draco, a small constellation in the northern hemisphere. The aberration, or slight change of relative position of the so-called fixed stars, was measured from a star in this constellation, γ *Draconis* by name.

Draco, an Athenian archon and lawgiver of the 7th century B.C. He has become proverbial as a bloodthirsty monster, and his laws have been described as written not in ink but in blood. As a matter of fact he appears to have introduced a period of fixed justice in succession to a period of misrule, and his code was the first at Athens. According to tradition, he appointed death as the penalty for all offences. A recently discovered work of Aristotle represents him as conferring the franchise on all who could bear arms.

Dracæna, a genus of *Liliaceæ*, including one species, *D. Draco*, an arborescent plant, having, unlike most Monocotyledons, a merismatic zone of fundamental tissue in which new fibro-vascular bundles originate, so that the stem increases indefinitely in diameter. The stem bifurcates repeatedly, each branch terminating in a head of linear-lanceolate entire green leaves. The flowers are small, greenish-white, and bell-shaped, in a large terminal panicle, and the fruit is fleshy, three-chambered, and one- or two-seeded. The tree does not branch till twenty-five or thirty years old. It is a native of Teneriffe, where, until blown down by a hurricane in 1867, was an enormous specimen, of unknown age, 70 feet high and 48 feet round, with a staircase within its hollow main trunk. This species yields one of the red resins known as dragon's blood (q.v.). The showy greenhouse plant with red leaves, known as *D. ferrea* or *D. terminalis*, is *Calodracon Jacquinii*, an allied but distinct plant.

• **Dragoman**, in the East, the name for a guide, or interpreter; also for an interpreter attached to an Embassy.

Dragon, a popular name for lizards of the genus *Draco*, of the family Agamidae (q.v.). The species, which range over the Oriental region, with the exception of Ceylon, have the nape crested; the hinder ribs are prolonged, and covered with an extensible skin, which forms a nearly semi-circular expansion on each side, enabling these animals to take long leaps from bough to bough. Sometimes the term is used poetically, as by Tennyson (*In Memoriam*, lvi.), for the gigantic saurians of Secondary times. The dragon of mythology is a winged serpent, sometimes with two and sometimes with four feet. It seems to be pre-eminently Aryan, and figures largely in Vedic and Greek myths, probably passing from the latter into those

of Western Europe. The dragon was the personification of evil, moral and physical, and the open and avowed enemy of man. This character, which it had in pre-Christian faiths, passed into Christian writings and symbolism, for St. John in the Apocalypse applies the name "dragon" to "that old serpent called the Devil and Satan," and in painting and sculpture of later times the dragon is a symbol of sin, and especially of heresy and schism. Hence to slay the dragon was to confer some great benefit on the human race, and we find such acts ascribed to heroes, gods, and Christian saints. There is, however, a substratum of truth in every myth, and the dragon was probably evolved from



HAROLD OF NORWAY AND THE DRAGON.
(From Olaus Magnus' History of the Northern Nations.)

more or less exaggerated stories of gigantic serpents. The Chinese dragon, as is shown in a Zoological Note in the *Magazine of Art*, 1891, pp. 371, 372, appears to have been developed from the Chinese alligator; and in 1869 one of these saurians—then generally supposed to be confined to the New World—was exhibited to the populace in Shanghai as a "real live dragon." Not only to the Chinese, but to many other races the dragon was a reality. We read of "fiery flying serpents" in the story of the wanderings of the Children of Israel in the desert, and Cruden, in the 18th century, was firmly convinced "that there were winged serpents." Gesner and Aldrovandi give circumstantial accounts of these animals; and the latter figures more than one kind. These monsters have a duck-like body and feet, with a serpent's head, and greatly elongated neck and tail, and vary only in minor points. But in those days there were mock-dragons, and the same authors give illustrations of some which crafty showmen had exhibited as the real animals. Olaus Magnus (*History of the Northern Nations*, published at Rome, 1555) gives a detailed account of the slaying of a dragon by "Harald, King of Norway." In his youth Harald travelled in the East, and there killed a man, and for this was condemned to be thrown to a dragon. With the aid of his servant, who consented to share his fate, he resolved to turn the tables on the monster. They bribed the keeper, and satisfied the dragon's hunger with some fish. Harald, armed with a sharp knife, then ventured into the den, followed by his servant, who chose for weapon the thigh-bone and skull of a former victim, who, judging from the picture, must have had disproportionately long legs and a very small head. They then despatched the dragon—no very difficult task, unless

the artist, as seems probable, has belied the monster. The Celts chose the dragon as the emblem of sovereignty; and a golden dragon figured on the standard of the West Saxons. The Tudors bore it as one of the supporters of the royal arms, till Mary substituted an eagle for it.

Dragonet, any fish of the Acanthopterygian genus *Callionymus*, with about 30 species, all of small size and generally of brilliant coloration, widely distributed in temperate seas of the Eastern hemisphere. In the males the fin-rays are produced into long filaments. The Glimmering Dragonet (*C. lyra*) is British; it is about a foot long, yellow with brown spots, and is locally known as the Skulpin, a name given in America to a marine species of *Cottus*.

Dragon Flies, a number of insects comprising the order Odonata. Their main characters are the similarity of the four wings, the large powerful jaws and incomplete metamorphosis. The skin is hard and is thrown off in a succession of moults to allow of growth. They are carnivorous in all stages; the larvæ and pupæ are both active and aquatic; they have tracheal gills. The principal family is the Libellulidæ, of which the large *Libellula depressa* (Linn.) is the commonest and best known of the fifty British species. The very large size of the eyes and the remarkable arrangement of the genital organs, which enables the male to fertilise the female during flight, are also features of interest. Owing to their powerful flight they are very widely distributed, one species (*Pantala flavescens*) being world-wide. The order is not, however, a very large one numerically: it includes about 1,700 species divided into three families. The largest species belong to the genus *Mesotogaster*, which has an expanse of wing of about 7 inches. The earliest known dragon flies occur in the Lias, but the best preserved ones are from the Solenhofen Slate of Bavaria (Upper Oolite).

Dragon's Blood, a dark red-brown resin, nearly opaque, brittle, soluble in alcohol, ether, and oils; of a fine red colour when powdered, giving off fumes of benzoic acid when heated, and said to have the composition $C_{20}H_{22}O_6$. It coats the cherry-like fruits of *Demonorops Draco*, one of the rattan palms of the Malay archipelago, the best quality, moulded in sticks ("sanguis draconis in baculis"), being melted off them, whilst the inferior lump kind ("sanguis draconis in massis") is extracted by boiling. A similar resin exuding from cracks in the trunk of *Dracanea* (q.v.) *Draco*, in the Canaries, gives it the name of Dragon-tree. Formerly valued medicinally as a tonic astringent, dragon's blood is now employed to colour oils and varnishes, to stain horn in imitation of tortoise-shell and wood in imitation of rosewood, in dentifrice, and in plasters.

Dragoon, a cavalry soldier. The earliest regiment of dragoons was raised in England in 1681. They are now classed as heavy or light dragoons, according to their arms and equipment. Originally they were more like the mounted infantry of to-day. The name is derived from the former ornamentation of the muzzles of their guns with a dragon's head.

Drainage Tubes are used by surgeons in order to facilitate the discharge of collections of matter, and with the view of keeping open a pathway of escape to the surface for deep-lying collections of pus. Thus in uniting the skin surfaces of an amputation wound a drainage tube is usually inserted in order that there may be no accumulation of discharges pent up in the amputation stump. As the wound gradually heals from within outwards the drainage tube is by degrees withdrawn. Drainage tubes are commonly made of indiarubber, and are often perforated by holes, so as to afford abundant scope for the escape of inflammatory exudation.

Drake, Sir FRANCIS, one of the greatest and boldest of the Elizabethan seamen, was the son of a Devonshire clergyman, and was born about the year 1539 near Tavistock. At an early age he was sent as an apprentice on board a trading-ship, the master of which dying, left him the vessel. After a time Drake sold it and embarked in new ventures, first to the Guinea Coast and later to the West Indies. In 1567 he again went to the Guinea Coast, this time with Sir John Hawkins, and to the Spanish Main. Having in these and other expeditions gained much knowledge of the position and riches of the Spaniards in the New World, he in 1592 fitted out two vessels—one the *Pasha* of 70 tons, which he himself commanded, and the other the *Swan* of 25 tons, commanded by his brother John, for what we should now call privateering operations against them. He plundered a number of settlements and took over two hundred ships, and, having greatly enriched himself, returned to Plymouth in 1573. In 1577, at the head of a larger force, he undertook a voyage, in the course of which he circumnavigated the globe, passing through the Strait of Magellan, proceeding to the coast of California, and coming home by Java and the Cape of Good Hope, after rather more than two years and ten months' absence. For his services on this occasion he was knighted, and was visited at Deptford on board his ship the *Golden Hind* by Queen Elizabeth. In 1585, in command of a squadron of twenty-five vessels, and with Martin Frobisher as his vice-admiral, he led an expedition against the Spaniards, plundering Vigo, St. Jago, St. Domingo, and Carthagena, and returning to Portsmouth in 1586. Against the Armada in 1588 he served as Vice-Admiral of England. Seven years later with Sir John Hawkins he sailed on his last voyage, another plundering expedition to the West Indies; and in the course of this, which was his only unfortunate adventure, he died on January 28th, 1596, off Puerto Bello, his end, it is believed, having been accelerated by the death of his old friend Hawkins. His ship the *Golden Hind* was long preserved in England by order of Elizabeth and her successors, and portions of it, made into articles of furniture, are still in existence. Drake, who had married Elizabeth Sydenham, died without issue; but many of the descendants of his brothers rose to honourable positions, and several served with distinction in the royal navy. Sir Francis was a short, broad-shouldered, brown-haired man, of

cheerful and engaging manners, and was one of the most accomplished navigators of his day. It would be unfair, since he was encouraged by Elizabeth and loyally served her, to attack his character on account of his deeds; but it cannot be denied that had the Spaniards caught him upon any of his American expeditions they would have been fully justified in hanging him as a pirate.

Drake, FRIEDRICH (1805-1882), a German sculptor born at Pyrmont. He was poor, and while a working engineer he used to carve in wood and ivory to eke out his resources. The sale at twenty-one years old of a head of Christ to an antiquary fired him to new efforts. He went to Berlin, where his talent was recognised by Rauch. His *Virgin with Child* was bought by the Empress of Russia. Among his chief works are *The Eight Provinces of Prussia*, *The Dying Warrior Crowned*, *The Vintage Gatherer*, and numerous statues and busts, including those of Bismarck and Moltke.

Drakenberge (Dragon's Mount), a generic name for the range of mountains between Cape Colony and the Vaal in South Africa. The three chains of which it is composed in the S. unite and run to the N.E., reaching a height of over 10,000 feet, and are crossed by the De Beers and Van Reenen passes at a height of 5,630 and 5,420 feet respectively.

Drama (Gk. *draō*, I do or act). A play may be defined as a composition in dialogue in which the action is not described, but acted or imitated, its aim being to "hold the mirror up to nature"; and the drama may be roughly divided into two kinds—Tragedy and Comedy, with numerous minor divisions. The love of mimicry is inherent in human nature, finding vent in all times and places, and among the rudest savages we can find traces of the fondness for mimic representations of the realities of life, which in civilised societies has produced some of the noblest literary masterpieces. The corroboree of the Australian aborigines and the wild dances of other savage races are forerunners of *Hamlet* and *Faust*, and the games of children are prophetic of the love of the theatre which will obtain in later years. The earliest theatrical representations in Europe originated with the Greeks, both tragedy and comedy being among the many gifts to posterity from that splendid people. We hear of a rudimentary comic drama in Greece from the 7th century B.C. According to tradition, the first comedy at Athens was produced by Susarion and Dolon in 562 B.C., and the first tragedy was written by Thespis 536 B.C. This author's name is still associated with all things dramatic. Both forms had their origin in the dances and choruses in honour of Dionysus (Bacchus), who was the patron deity of the theatre, and the chorus remained a feature of the Greek drama. The golden days of the Grecian theatre commenced with Æschylus, who made use of two actors in addition to the chorus and also introduced the use of scenery, the mask, and the citharnus or tragic buskin. His most famous countrymen in the writing of tragedies were Sophocles and Euripides; in comedy, Eupolis, Cratinus, and, beyond all, Aristophanes. Of the

new Greek comedy of Menander and others we can only judge by means of Latin adaptations, for though the Romans had rude dramatic beginnings of their own (COMEDY), the theatre with them attained no position till the Grecian drama was introduced about 364 B.C. Seneca, probably the philosophic minister of Nero, is the only Roman tragic writer of whose works we have any specimens, and these productions, bombastic and tedious, do not favourably impress us with the worth of Roman tragedies. Plautus and Terence are their two greatest writers of comedies, but their work is little more than the adaptation of Greek originals. A strange gap, caused, perhaps, by the horror in which the early Christians not unreasonably held such a pagan institution as the theatre, comes between the ancient and modern drama. With the exception of the works of a select school of poets in Italy, who, perhaps, held that imitation best expressed their admiration, the modern drama has slowly grown up from the miracle and mystery plays of the Middle Ages, by means of which the Church endeavoured to teach the history and mysteries of the Christian religion to an illiterate public. Italy, however, commenced with a series of reproductions of classical models, the earliest tragedy being the *Sofonisba* of Trissino (1502). To the 15th and 16th centuries belong the Pastoral Plays, and in the same centuries Ariosto, Ariano, and Machiavelli were distinguished as writers of comedy. After a long period of depression the drama was raised to a high place by Goldoni and Alfieri, and amongst later writers may be named Monti, Manzoni, and Niccolini. Until the advent of Corneille the French drama was only distinguished by its mediocrity, but since then French dramatists have taken a foremost position in the history of the drama. Racine, Molière, Voltaire, Beaumarchais stand out conspicuous, and in later days Hugo and Dumas led the attack made by the romantic upon the classical school. Of still more recent writers we may name de Vigny, de Musset, Mérimée, Augier, Scribe, Dumas *fils*, Sardou, and Daudet, who with a number of others have by their wit and ingenuity upheld and increased the brilliancy of the French theatre. It will not be out of place to record that the aid of the State has done much to encourage the art of acting in France, and that the actors of that country have long held the foremost place for polish and finish, as is well attested by such names as Favart, Talma, Rachel, Got, Delaunay, Lemaître, Bernhardt, and Coquelin. In Spain dramatic art attained its highest point with Lope de Vega and Calderon. In Germany Lessing broke the spell of French tradition and practice, but his fame has been overshadowed by that of Schiller and Goethe. Of other prominent writers the most noteworthy are perhaps Körner, Schlegel, Tieck, Grillparzer, and Freytag. The Dutch drama numbers amongst its highest ornaments Koster and Vondel, and of Scandinavian dramatists Holberg, Oehlenschläger, Björnson, and Ibsen are the best known. Turning now to our own country, the history of whose drama we shall trace more fully, we find that the Mystery and Miracle plays gradually gave place in popular

esteem to the Moralities, and that these insensibly developed into the drama proper. These early plays were, as their names imply, entirely religious in character, and were at first written and acted by churchmen. The Moralities were allegorical, not historical, and one of the most important characters was the Vice, the lineal predecessor of the modern clown. John Ball is a typical writer of the transition stage of the English drama. He was the author of some of the latest Mysteries and Moralities, which he used as vehicles for bitter attacks upon Popery. But his most interesting production is his play of *King John*, founded upon the chronicles of that king's reign. It is the first historical play, and in a way the last of the Moralities, for amongst its characters we find such personages as Widowed England, Verity, Treason, and Seditious. *Ralph Roister Doister* was the first regular English comedy, and the author was Nicholas Udall (b. circa 1504, d. 1556). It possesses considerable spirit and observation of character, relating the adventures and follies of a rich young man surrounded by flatterers and sycophants. This piece was followed by *Gammer Gurton's Needle*, of far inferior merit, written by John Still, Bishop of Bath and Wells. The first tragedy, *Gorboduc*; or, *Ferrex and Porrex*, was the production of Thomas Norton and Thomas Sackville, Lord Buckhurst, and was acted in 1561 by the members of the Inner Temple before Queen Elizabeth. The theatre in the modern sense of the word had as yet no existence, no separate building having ever been set apart for the performance of plays. The players wandered from place to place, acting in inn-yards, banquetting halls, barns, and other suitable places, and unless under the patronage and protection of some peer or great man, in whose service they were supposed to be, were considered and treated as vagabonds and vagrants. The Blackfriars theatre was opened in 1576 by James Burbage and his company of players, who had been driven from the City by the intolerant persecutions of the Corporation. (For a description of the theatre and the performances, see THEATRE.) It is noteworthy that many of the early dramatists were actors, notably Marlowe, Ben Jonson, and Shakespeare. In the later days of Elizabeth and the early years of the reign of James I. the English drama reached a height of splendour such as it has never since approached. Headed by Shakespeare, we find then a band of writers who singly would have shed lustre on their age, who together have rendered the drama of their day unequalled for its poetry, vigour, and profound knowledge of human nature. Lyly, Kyd, Greene, Peele, Marlowe—who first mastered the beauties of blank verse—Ben Jonson, Beaumont and Fletcher, Webster, Tourneur, Middleton, Dekker, Marston, Ford, Massinger are among the more notable of Shakespeare's fellow-workers. Shakespeare himself must stand alone. Under the Commonwealth the performances of stage plays were put a stop to by the Puritans, but on the Restoration Charles II. restored the theatre to favour. A new school arose; the Elizabethan dramatists were considered barbarous and crude;

artifice and wit displaced poetry and nature; and the tastes acquired by the king during his long exile are chiefly responsible for the sensuality and immorality that is the distinguishing feature of the revival of the drama. Dryden, Davenant, and Killigrew may be named as among the earlier, and Shadwell, Settle, Lee, and Otway among the later writers of this period. But the revival is chiefly to be remembered for the brilliantly witty but licentious comedies of Wycherley, who was ably followed by Congreve, Vanbrugh, and Farquhar. Their plays are utterly unreal, the world they depict entirely false; morals there are none, and every character speaks with equal wit and acts with equal indecency. Jeremy Collier, a nonjuring bishop, published in 1628 *A Short View of the Profaneness and Immorality of the English Stage*, a bitter attack on this school of dramatists, which called forth more or less feeble replies from Congreve, Vanbrugh, Dennis, and others, and a more manly confession of guilt from Dryden. These writers were followed by Steele and Addison, whose *Cato* is a strange example of temporary and undeserved success; Goldsmith, who has given the theatre two masterpieces; Colley Cibber, Gay, Garrick, and the brilliant Sheridan, who rivalled in wit any of his predecessors. We now come to what may fairly be termed the drama of the present day, when it is necessary to a certain extent to divide it into two classes—one purely literary, the other theatrical and too often non-literary. In the former class, though some of their plays have been seen on the stage, the chief representatives are Byron, Shelley, Milman, Browning, Tennyson, and Swinburne. Their works—many of them holding a foremost place in the literary productions of our country—have added few to the number of our acting plays, and it appears to be becoming more and more customary for literary men to ignore the theatre as a vehicle for bringing their best work before the public. Talfourd and Planché in lighter work, and Knowles and the first Lord Lytton hold a position somewhat between these two schools of writers of the drama, and the plays of the latter seem to have gained a permanent place in the *répertoire* of our leading actors. The same may perhaps be said of Tom Taylor and W. G. Wills. Of those who may be distinguished rather as playwrights than dramatists we may mention Douglas Jerrold, Charles Reade, Dion Boucicault, Thomas Robertson, and Henry J. Byron, and of writers of farce Matthews and Morton, the author of that immortal farce *Box and Cox*. In recent years the drama has shown some symptoms of revival. It is customary to depreciate English dramatic authors of to-day, and to say that we owe their best work to French originals. To a certain extent this charge is true and borne out by facts, but it is unfair to ignore the large amount of vigorous and worthy work that has been achieved by several of our most popular dramatists. W. S. Gilbert holds perhaps a place apart. He has originated—and as yet had no rivals in their production—the amazingly clever and charming operas which, in conjunction with Sir Arthur Sullivan and other composers, have achieved immense and well-deserved

popularity. His more ambitious productions both in comedy and drama are of a high standard of ability, and are distinguished for literary as well as for dramatic power. Robert Buchanan also has given much good work to the stage. Sydney Granly, Henry Arthur Jones, and Arthur Wing Pinero have written many plays of striking merit, and the popular approval that meets the production of plays of serious import and artistic aim bodes well for the future of the English drama. (*See THEATRE, TRAGEDY, COMEDY*, and the various names mentioned in this article.)

Dramatic Unities. From the study of Aristotle's *Poetics* and the Greek dramatists critics have laid down three rules of dramatic construction: (1) *the unity of time*—the action depicted in a drama must all take place within 24 hours; (2) *the unity of place*—there must be no change of locality; (3) *the unity of action*—there must be no "underplot" or second theme in the play. The observance of these unities marks the classic drama of France. They are occasionally departed from by the Greek dramatists, and are of course quite unrecognised by Shakespeare.

Drammen, a Norwegian seaport on the Dramselt, a river falling into the Dramsfjord, an inlet of Christiania Bay. It is 33 miles S.W. of Christiania. The river is the second largest in Norway, and is crossed by three bridges. The town is in three parts and the principal industry is the exporting of timber, and there are also saw-mills and chicory factories.

Draper, JOHN WILLIAM, M.D., LL.D. (1811-1882), chemist and physiologist, was born at Liverpool. He went to America in 1833 and became Professor of Physical Science in a college in Virginia, and later, Professor of Natural History, Chemistry, and Physiology in the University of New York. He contributed much to scientific literature, and made discoveries concerning the chemical action of light. Other works of his are *History of the Intellectual Development of Europe*, *a History of the American Civil War*, *History of the Conflict between Science and Religion*.

Draught, in *Engineering*, means the supply of air necessary for the combustion of coal, coke, or other fuel in a furnace of any kind. This supply may be induced in various ways, which may be classified as *natural draughts* or *forced draughts*. With a column of warm gases passing up an ordinary chimney, a draught is produced simply by the external pressure of the colder air outside overcoming the smaller pressure of the warm gases within. Such a natural draught is intensified by increasing the difference of temperature between the internal gases and the external air, or by lengthening the chimney. On locomotives the natural draught cannot conveniently be increased by lengthening the chimney, and it is therefore assisted by letting the exhaust steam at the end of each stroke discharge itself upwards in the chimney. This has the effect of drawing the air more vigorously into the furnace. Natural draught is also assisted by placing a cowl or small fan at the top of the

chimney. This is rotated by the wind, and acts as a pump to draw the gases up the flue. Constrictions in the flue may considerably modify the draught; *dampers* are valves placed for the special purpose of varying the draught by introducing greater or less constriction in the flue. True forced draughts are those where the whole supply of air or oxygen is obtained by mechanical means. Thus, it is a general plan to use large pumping engines to force air through the furnace. The supply may be varied at will, and admits of much greater range than is possible with natural draughts. One very convenient means adopted for the production of forced draught in small forges is to work a light fan at quick speed by a long lever. The efficiency of such an arrangement, the supply of forced air passing from the fan to the centre of the furnace, is much greater than that of the ordinary bellows.

Draughts, a game played on a chess-board with twelve men on each side, placed, at the beginning of the game, on alternate squares. These men are moved diagonally, and the object of the game is to capture one's opponent's pieces, which is done by moving over an adversary to an unoccupied square beyond. When a piece succeeds in traversing the length of the board it becomes a "king" and has the power of moving backwards as well as forwards. The game of draughts was known in the 16th century.

Drave (the Roman *Dravus*), one of the chief tributaries of the Danube, rises in the Austrian Tyrol and flows S.E. through the provinces of the Tyrol, Carinthia, Illyria, and Styria into Hungary, which it separates from Slavonia, and falls after a course of 447 miles into the Danube. At first a mountain torrent, it receives many tributaries, and is navigable for 380 miles. A little gold is found in the sands, and there are fine fish.

Dravidians, properly the inhabitants of Dravida (Dravira), which in Hindu geography formed a main division of the Dekkan; but the term is now applied conventionally to all the inhabitants of South India who speak dialects of a now extinct stock language, which differs fundamentally from all other known forms of speech. The Dravidians, who, like the Aryans, probably entered India from the north-west, had already long been in possession of the greater part of the peninsula at the time of the Aryan migration, but were gradually driven by these intruders from the Indus and Ganges valleys southwards to their present domain, that is, the whole region south of Gondwana and the upper course of the Krishna, together with the northern half of Ceylon. Here they form five great nations, speaking five cultivated languages, besides numerous smaller groups speaking uncultivated languages, with a collective population (1901) of considerably over 50 millions, as under: Telugu, 20 millions; Tamil, 16; Kanarese, 10; Malayalam, 8; Gondi, 1; Tulu, 0.5; Khondi, 0.3; Ordon, 0.59; Kodagu (Coorg), 0.20; Rajmahal (Maler), 0.050; Tuda, Kota, Badaga, Kurumba, Irula, Rutluk, Madi (Muria), Kelkadi, Yernkala, and others. The cultivated languages (Telugu,

Tamil, Kanarese, Malayalam, and Tulu) are all written with syllabic alphabets derived from Devanagari [DEVANAGARI], but betray no trace of Sanscrit influences in their structure, though containing considerable percentages of Sanscrit loan words. On the other hand the Dravidian populations have been largely assimilated by secular interminglings with the Aryan populations, so that Peschel (*Races of Man*, p. 451) goes so far as to assert that "the inhabitants of India form a present but a single race, and the separation of the peoples resident between the Himalayas and the Vindhya Hills from the Dravidas of the Dekkan is based solely on the fact that the former speak languages derived more or less directly from the Sanscrit." Nevertheless certain differences are observable between the Aryans and Dravidians, the latter being of much darker complexion and lower stature, with somewhat broader features, more kinky hair, scant beard, rather broad flat nose and dolichocephalic (elongated) skull. Most of these traits point at an admixture of a black element and it is now generally believed that the Dravidians are not the aborigines, but found the peninsula when they arrived already occupied by a dark Negrito race, which they partly exterminated and partly absorbed. These Negritos may still be represented by certain black and almost dwarfish low caste tribes, such as the savage Kaders, Malasars, Madavars, Paligars, and Pulayars of the Annamaleh Hills and Travancore, the Veddis of both of the mainland and Ceylon, the Irulas, Khotas and Kurumbars of the Nilghiri uplands. On the other hand there are several groups distinguished either by their finer physique or superior intelligence from the ordinary Dravidian standard. Such are the tall, hirsute Todas of the Nilghiries, probably of Aryan descent; the Nairs (Nayars) and Namburi of Malabar, who claim to be high cast Hindus (Brahmans or Kshatriyas); the Moplahs (Mopilas) and Tirs (Tayars) of Travancore, many of whom are Mohammedans, and all of whom appear to have sprung from alliances between Aryan immigrants and the Dravidian natives. Apart from these and a few Christian communities all the Dravidians profess some form of the Hindu religion, and the arts and letters of the civilised natives have been developed under Aryan influences (Caldwell, *Comparative Grammar of the Dravidian Languages*, 1852; Elphinstone, *History of India* 1811; J. Campbell, *Ethnology of India*, in *Journal of the Asiatic Society*, ii. 1866; Malletson, *The Native States of India*, 1875.)

Drawbacks, in *Commerce*, are repayments on the whole or part of the duty levied on goods (either manufactured at home or imported) when the goods are exported. They were frequently given in the 18th century to encourage the importation, trans-shipment, and re-exportation of goods and therefore the carrying trade of a country. The establishment of bonded warehouses (q.v.) has to a great extent obviated this use of them. Adam Smith speaks of them as "a reasonable encouragement to trade." Whereas a drawback enables goods to be sold to the foreigner at their natural price

a bounty (q.v.) on export may enable them to be sold to him for less than that price. They were, of course, as stimulating exportation, an essential part of the mercantile system (q.v.).

Drawing Room, a reception of company by the Sovereign or by some member of the Royal Family acting for the Sovereign.

Drayton, MICHAEL (1563-1631), an English poet, studied at Oxford, and then received a commission, and fought in the engagement with the Armada. His great work, published partly in 1613 and partly in 1622, was the *Polyolbion*, a poetical topographical account of Great Britain, accurate in details and abounding in fine passages. Other works are *Nymphidia*, *Court of Fairy*, *The Barons' Wars*, *Legend of the Great Cornwall*, *The Battle of Agincourt*, his last being *The Muses' Elysium* (1630). In 1626 he became poet laureate, and was buried in Westminster Abbey.

Dreams. Dreams arise from the fact that the brain is often in a state of partial activity during sleep; hence profound sleep is almost certainly dreamless, though some maintain that even in that condition we do dream, though on waking we do not remember what we have dreamt. The subject-matter of dreams is some previous, and generally recent, mental experience; but we are quite ignorant as to the manner in which this is recalled during sleep. Physical causes also induce and modify dreams; an uneasy position, an overloaded stomach, impeded respiration or circulation, or a low state of health, will generally cause uncomfortable dreams, and the sleep which follows over-indulgence in alcoholic and other stimulants is usually disturbed by wild, fantastic visions. Dreams have played an important part in the history of all faiths. Tylor considers them to have been the germ whence the idea of the soul was first developed amongst races of low culture; and in every faith they have been considered one of the means by which the Divine will was conveyed to man (Job xxxiii. 14-16). [DIVINATION.]

Dredging, a process of removal of matter from the bottom of rivers, lakes, or seas, for scientific or commercial purposes. The instrument required for gathering up specimens, etc., is known as a *dredge*. It consists essentially of a strong square netted bag lined with canvas, with two parallel metal scrapers fixed at a distance apart of about 8 inches on each side of the mouth of the bag. The depth of the bag is about two feet, but varies according to the nature of the work to be done with it. A curved iron handle with ends fixed to each side of the mouth serves as a holder for the dredge, which is raised or lowered by a well-tested rope attached to the middle of the handle. A canvas flap is sometimes used as a lid to the case, to protect delicate specimens within, though not preventing the entrance of fresh objects. Commercial dredging has received a great deal of attention in recent years. So much depends on the clearance of silting or deposition of mud and gravel at the bottom of canals, docks, etc., that it is necessary to devise efficient methods of removal, if the plans for its

complete prevention manifest themselves imperfect. Scouring-basins have been introduced in tide-harbours, in which the strong currents due to the tides are made to preserve a clearance in the right localities. Of small dredging-machines the spoon apparatus is an example. It consists of a tough bag of hide or leather attached to a stout iron ring and dragged along the bottom of the waterway at the end of a long pole. The dragging is done by a winch; the loaded bag is lifted out of the water by a crane and emptied into the barge which carries the apparatus. In large continuous dredging operations some form of steam-dredger is used. The bucket-dredger was first employed by Rennie at Hull. The principle is that of an endless chain passing round two fixed barrels, provided with iron buckets at regular intervals. The chain is erected vertically in a steamboat, with one end passing through a long opening at the base of the vessel and reaching down to the level of the cutting. When the chain is rotated, the buckets pass down with one side of the chain to the mud or silt at the bottom of the channel. They scoop up a certain quantity and then pass up on the other side of the chain till in a position to drop their contents into a barge or other near receptacle.

Dreissena, a genus of mussels, differing from the common *Mytilus edulis* by the absence of the pearly internal layer. The best-known species, *D. polymorpha*, is a brackish-water inhabitant and a native of the rivers of the Aralo-Caspian area. It was first observed in England in the Commercial Docks (Surrey) about 1824, but it has since spread into most of the rivers and canals. It appears to have been introduced attached to timber.

Drenthe, a border province of Holland, touching on Hanover, Ober Yssel and Friesland. It contains 1,030 square miles. The soil is poor, and about one-half is peat and bog. The chief pursuits are agriculture, cattle-feeding, and peat-cutting.

Dresden, the capital of Saxony, is on the Elbe, 62 miles S.E. of Leipzig. It consists of two parts—one, Altstadt and Friedrichstadt on the S. bank of the river; the other, Neustadt and Antonstadt on the N. bank. The river is crossed by three bridges, two of which, the Augustus and Albert Bridges, have some architectural beauty, and the other, the Marienbrücke, is for railway and carriage traffic. The town is pretty and pleasantly situated, and is ornamented with squares, statues, and gardens. On the S. bank is a good promenade called the Brühl Terrace. Among its attractions are the Academy of Arts, with fine drawings and architecture, the choir of the Catholic cathedral, the conservatoire of music, the museum with a fine collection of engravings, drawings, and 2,400 pictures—chiefly Italian and Flemish. The Zwinger, once built as the vestibule of a projected palace, is a museum, and the Johanneum, once royal stables, contains a historical museum, a gallery of arms, and a magnificent collection of porcelain. There are also the Augusteum, a museum of antiquities, a royal public library, the royal palace, with a notable collection of

precious stones, etc. The Grosse Garten is a large park of 350 acres. The town has also palaces, a town hall, and fine theatre. Of the churches the chief are the Frauenkirche, the Sophienkirche, and the Kreuzkirche. There are many industries, but Dresden china is made elsewhere. The Elbe furnishes a ready means of communication. Dresden has played no small part in the history of Germany. Of Slavonic origin, it has often suffered in war. Napoleon received here a reverse from Russia; and the town was occupied by the Prussians in 1866.

Dreux, a French town on the river Blaise in the department of Eure and Loir, is situated beneath a hill 25 miles N. of Chartres. On the top of the hill is a castle of the ancient Counts of Dreux, and among the ruins is a beautiful chapel, designed by Leffranc, built in 1816, and now containing the bodies of Louis Philippe and other Orleans princes who died in exile. The town hall of 1513, and the church of St. Pierre—of several periods—are good specimens of Gothic architecture. Dyeing, ironware, leather, and hats, are the chief objects of industry. The Prince de Condé was captured here in 1562.

Dreyfus, ALFRED, a French captain, convicted in 1894 on the charge of having divulged military State secrets to a foreign power. Shortly after his banishment to the Ile du Diable, an agitation to cancel his conviction was instituted, and an extraordinary state of affairs in the French army was revealed. In 1899, after overcoming unparalleled obstruction, the friends of Dreyfus secured the quashing of his sentence and an order for his retrial. The second court-martial in 1899 found him guilty, but soon afterwards the Government pardoned him, and he was set at liberty. In 1906 his innocence was definitely and legally confirmed.

Dreyse, JOHANN NIKOLAUS VON (1787-1867), the inventor of the needle gun, was born near Erfurt in Prussia. The son of a locksmith, he was apprenticed to his father, and then after his *Wanderjahr* he was employed in an arms factory in Paris (1809-14). He then went home and opened a factory, where he manufactured percussion caps. In 1827 he invented a muzzle-loading needle-gun, and in 1836 the breech-loader, which was adopted in 1840, but did not come greatly into notice till the war of 1866. He was ennobled in 1864.

Driffield, GREAT, a town of the Yorkshire Wolds, in the East Riding, 11 miles N. of Beverley. A canal connects it with Hull, 19 miles away. It is in a fertile district, and there is a considerable trade in corn, cattle, flour, linseed cake, and artificial manure. Pop. (1901), 5,766.

Drift. [DILUVIUM, GLACIAL PERIOD, PLEISTOCENE.]

Drill, the training of soldiers or other persons to perform certain sets of actions smartly and spontaneously at the word of command or other signal (e.g. a musical sound). In the army drill may be classed roughly as either gymnastic drill, marching drill, or gun drill.

Drilling Machine is a special form of lathe used for cutting holes in metal. The centre-line of the machine is generally vertical, the drill working with a rotatory motion and feeding downwards. The material to be drilled is fixed on a circular or rectangular metal table. [BORING]

Dripstone, in *Architecture*, the projecting moulding over a doorway or arch, usually following the shape of it. The ends are often ornamented with sculpture, sometimes carved into a floral ornament, as in the Decorated style.

Drogheda, a seaport town of Ireland, forming a county of itself, in the S.E. of county Louth, on the Boyne, 4 miles from the mouth of the river, and 32 miles N. of Dublin. A railway viaduct, 98 feet high, here crosses the Boyne. The river admits vessels of 500 tons, and is navigable for those of 50 tons up to Navan (19 miles). Of the population the great majority are Catholic. There are manufactures of linen, cotton, iron, and salt, and brewing and tanning are carried on. There is also a brisk export trade with Liverpool in corn, flour, cattle, butter, eggs, linen, and hides. Cromwell sacked Drogheda in 1649, and put the garrison to death.

Drohobyecz, a town of Austrian Galicia, 50 miles S.W. of Lemberg. Of its population about half are Jews. Salt, paraffin, and dye are the chief productions.

Dromæognathæ, a group of Carinate birds, in which the vomer is broad behind. [TINAMOU.]

Drôme, a department in the S.E. of France, noted till the arrival of the phylloxera for its growth of Hermitage. In the south spurs of the Alps rise to a height of 5,900 feet, and the country is hilly, partly covered by forests and furrowed by torrents. But in the Rhone Valley the land is fertile, and the warm climate produces almonds, olives, oilnuts, and mulberries. Wheat, melons, potatoes, and truffles are also abundant. The Rhone separates Drôme from Ardèche on the W., and the Isère and Drôme both flow through the department. Coal, cement, and potter's clay are found. The chief productions are silk, woollen, pottery, iron goods, paper, leather, and glass, and there is considerable trade in raw produce. The department contains 2,508 square miles. The capital is Valence.

Dromedary, a North African variety of *Camelus dromedarius*, bred for riding, and not for carrying burdens. It is much more lightly built than the ordinary camel (q.v.), but has equal, if not greater, powers of endurance. At a swinging trot it can cover from eight to nine miles within the hour for many hours in succession, and some have been known to travel 900 miles in eight days. There are several breeds, varying from cream to nearly white, and some are used for racing.

Dropsy. In this condition there is an accumulation of thin watery fluid in the tissues and serous sacs (pleura, peritoneum, etc.) of the body. A general dropsy, i.e. where the whole of the subcutaneous tissues throughout the body are involved

is spoken of as *Anasarca*; when the accumulation of fluid is confined to the peritoneal cavity the condition is called *Ascites*. Disease of the heart, Bright's disease, and emphysema of the lungs are causes of general dropsy (*anasarca*). In heart disease the waterlogging of the tissues is apt in the first instance to affect the most dependent parts, notably the legs. Later, ascites, pleural effusion and œdema of the upper extremities, trunk, and face supervene. The dropsy associated with certain forms of disease of the liver commonly commences as ascites, the swelling of the legs and other parts being a symptom of later development. The conjunctiva is one of the earliest sites involved in dropsy due to renal disease, leading to "puffiness of the eyelids." The treatment of dropsy depends largely upon its cause. In some cases the distension brought about by the collection of fluid in the tissues is extreme and has to be relieved by tapping, and so permitting the escape of the accumulated fluid.

Droseraceæ, a small but widely distributed order of herbaceous plants allied to the saxifragæ. They have generally white flowers with five sepals, five petals, five, ten, or fifteen stamens, and three to five styles, the ovary being one-chambered and forming a many-seeded loculicidal capsule. They are marsh plants with but slightly developed roots and are all apparently carnivorous plants (q.v.). *Drosera*, the largest and most widely dispersed genus, gets its scientific name and the popular name, sundew, from the drops of viscid liquid excreted at the apex of the hair-like "tentacles" or lobes of its leaves. This secretion, present in several of the other genera, is absent in *Dionæa* (q.v.), where its function is replaced by the instantaneous electrical folding of the leaves. *Drosera* is reddish, having little chlorophyll, and its flowers are small and often cleistogamous.

Drouet, JEAN BAPTISTE, COMTE D'ERLON (1765-1844), a French general, served (1793-96) in the campaigns of the Moselle, Sambre, and Peninsula; he gave the turning point to the victory of Jena (1806), and was badly wounded at Friedland in 1807. He commanded the 1st corps d'armée at Waterloo, but through conflicting orders remained inactive. After Napoleon's fall he for a time brewed beer at Munich, but returned to France when the amnesty was granted in 1825. In 1834-5 he was Governor of Algeria, and became Marshal in 1843.

Drouyn de Lhuys, EDOUARD (1805-1881), a French statesman and diplomatist, entered the diplomatic service in 1830. He was chargé d'affaires at the Hague when the Belgian revolution broke out. In 1840 he was head of the commercial department of the foreign ministry, but he opposed Guizot in the Chamber, which he entered in 1842, and lost office in 1845. He became foreign minister again under Odillon-Barrot in 1848, English ambassador 1849, and foreign minister from 1851, after the *Coup d'État*, to 1855. He was for a time head of the State railways, and he endeavoured to prevent the Crimean war. In 1862 he was again foreign minister, and tried to bring about

the reconciliation of Rome and Italy. After the Prussian war of 1866 he was in favour of French intervention. After the fall of Napoleon III. he retired to Jersey, but afterwards returned to France, where he died.

Droz, GUSTAVE (b. 1832), a French novelist. He at first studied art, but turned to literature and proved a success in *La Vie Parisienne*, where he wrote over the signature "Gustave Z." His *M., Mme., et Bébé*, *Entre Noms*, and *Cahier Bleu de Mlle. Cibot* appeared in that journal. Other works of his were *Cahier d'une Femme Mariée*, *Autour d'une Source*, and *Un Paquet de Lettres*. He showed much versatility and delicacy of sentiment, together with talent and wit. He died in 1895.

Drugget, a coarse fabric, either all wool, or one half wool and the other cotton, linen, or silk. The name, which is French, is of doubtful origin. Druggets are used to protect carpets, or instead of them, the finer kinds being used as table covers, etc. A similar material (half linen) was formerly used as clothing.

Druidism, the religion of the Gauls and Ancient Britons, formerly thought to be a distinctively Celtic faith, but Professor Rhys (*Celtic Heathendom*) maintains that these peoples derived it from a pre-Celtic and non-Aryan race. If this be so, the tradition of such a race had died out in Gaul hard on 2,000 years ago, for the Gauls asserted that they were autochthons (Cæsar: *de Bell. Gall.* vi. 18). According to Cæsar, who had opportunities of studying it on the spot, Druidism originated in Britain, and passed thence across the Channel. It seems to have been primarily a system of nature-worship, which in time became tinged with Eastern philosophy, and to have had an exoteric and an esoteric side, though, contrary to what one would expect, metempsychosis was taught to the people. The Druids, who formed a distinct class, were not only priests who offered sacrifices and taught the people their duties to the gods; they also acted as judges in civil and criminal affairs. Unlike the German priests they took no part in war. The novices had to undergo a long training, sometimes lasting twenty years, and the secret lore was committed to memory, "for they did not want their doctrines to be published to the vulgar." Cæsar tells us that the Druids could write and made use of Greek characters. This probably explains whence they got the idea of metempsychosis. He gives a circumstantial account of some of their terrible human sacrifices. Their practice seems to contradict their doctrine, for it is hard to conceive men holding the doctrine of transmigration of souls offering human sacrifices, or indeed any involving the death of the victim. Many of their sacred rites were performed in groves, and they considered the oak-tree sacred. Indeed, some derive the name Druid from the Greek *drus*, an oak, but Skat considers it to be from the Irish *druidh*, an augur. The Druids were intensely patriotic, and roused the people against the Roman invasion, so that Claudius forbade Druidical rites to be practised, and Suetonius Paulinus, in 61 A.D., massacred a great number of Druids in Anglesey, when he

put down the rebellion in the island. [CAENAC, STANDING STONES, STONEHENGE.]

Drum, in machinery, is a hollow cylinder, round which ropes or chains may be wound for convenience of storage. The term is also used to denote wide pulleys fixed on shafting, from which belting passes to different machines. The drum-armature [ARMATURE] is an arrangement in which coils of wire are wound lengthwise round a cylindrical drum in such a way as to enclose it completely. The wire is in several sections, the two ends of each section being carefully separated so that any electric current that is induced in the wire by rotation of the armature in a magnetic field may be withdrawn and utilised. [DYNAMO-ELECTRIC MACHINERY.]

Drum. The drum known to the Greeks was pre-eminently the instrument of the Earth-mother, Cybele, and was used in her worship. She was a Phrygian goddess, and the drum is probably of Phrygian or Syrian origin. According to one Greek legend, which also seems to have taken its rise in Phrygia, it was invented by the Corybantes (q.v.) to drown the cries of the infant Bacchus, when his father Zeus sought to slay him. These drums were, however, like the modern tambourine (q.v.) in construction, but some represented in vase paintings are (like the modern kettledrum) a hollow hemisphere of metal, across the opening of which is stretched a surface of parchment. The presence of the metal greatly increases the definiteness of the sound. The drum seems to have passed from Western Asia to India, and was introduced into European armies either by the Crusaders or the Moors of Spain. It is mentioned by Froissart at the entry of Edward III. into Calais (1347). Modern drums are of various types. The *kettledrum*, from its construction (see above), is the only kind that can be accurately tuned, or that can be said to give out definite musical notes. The *side drum*, the best known military type, consists of a hollow wooden or brass cylinder, with a head or membrane stretched tightly across each end and fastened round a hoop. A larger hoop presses this down, and cords which can be tightened connect the two heads. Cords of catgut, called *snarres*, are stretched across the lower end (when the drum is hung vertically) and rattle against it when it is struck. At military funerals it is "muffled" by putting cloth between the snarres and the membrane. The "roll" (two blows with the left drumstick followed by two with the right, and so on in rapid succession) requires a special knack in the drummer. The bass drum is a cylinder usually rather long in proportion to its breadth, played with one stick, commonly of whalebone. The sticks for side drums are of hard wood, terminated by a knob. Gong drums, in shape like a large tambourine, are occasionally used in orchestras. Though regular military drum calls expressed in musical notation exist, yet the drum is so imperfect an instrument in giving distinct sounds that the bugle is usually substituted. All the types are used in orchestral music.

Drum Major, the chief drummer in a regiment, or, more properly, the non-commissioned

officer (now called sergeant-drummer in the English army), whose business it is to transmit orders to the drummers.

Drummond, THOMAS (1797-1840), an English captain of Engineers, was born at Edinburgh. After studying at Edinburgh and at Woolwich, where he invented a pontoon and gave other proofs of talent, he entered the Engineers. He was appointed assistant to Colonel Colby in making the trigonometrical survey of Great Britain and Ireland, and in the latter country he achieved success with the limelight which he had invented, and enabled a signal to be seen at 66 miles distance in spite of foggy atmosphere. In 1835 he became Under-Secretary for Ireland, and for five years gave great satisfaction by his sympathy with Irish ideas, and his wise administration.

Drummond, WILLIAM, of Hawthornden (1585-1649), a poet who has been called the "Scottish Petrarch." He was born at Hawthornden House, and after studying at Edinburgh University, he travelled abroad for four years, spending part of the time at Bourges in the study of the civil law. He then retired to Hawthornden, and gave himself up to poetry and literature. Ben Jonson paid him a short visit in the winter of 1618, and he made notes of Jonson's conversation, which were published in 1741. In his poems he abandoned the Scottish dialect for the Elizabethan English then in vogue. He has been thought to resemble Milton in style. Some of his chief works are the *Cypress Grove* (prose), a set of reflections upon death, *Polemo Middenia*; or, *Battle of the Dunghill*, and a history of the lives and reigns of the five Jameses of Scotland. His style was ornate, his views were High Church, and he was devoted to the Stuarts. Indeed, the death of Charles I. has been said to have hastened his own.

Drupe, a succulent fruit composed of one carpel, superior, and containing one, or rarely two, seeds. It is characteristic of the sub-order *Drupacee* of the *Rosaceae*, the "stone fruits," such as plums, cherries, apricots, peaches, etc., and has a pericarp (q.v.) of three distinct layers: the *epicarp* or skin, the *mesocarp*, generally fleshy, and the *endocarp*, or stone, containing the seed ("kernel"). The epicarp may be glossy, as in cherries; glaucous, as in plums; or woolly, as in peaches. The term is often loosely used of somewhat similar fruits, such as the syncarpous olive, the date, in which the "stone" is a seed, and the walnut, which is inferior and bi-carpellary.

Drury Lane Theatre was first opened in 1663. This building was burnt, and another on the same site, built by Wren, opened in 1672. Garrick (q.v.) acted Shakspeare's plays here, and the best period of the theatre was under his management. The building was again burnt in 1809, and reopened with a prologue by Lord Byron. It was this fire that occasioned *Rejected Addresses*. Macready and Charles Kean (q.v.) were also among its lessees. With Covent Garden, it was opened under a patent from the Crown, and it is owned by a body of "renters," whose rights to admission have long been a source of friction with the various lessees.

Drusus, MARCUS LIVIUS. 1. Tribune of the Roman people 122 B.C. He opposed Caius Gracchus by outbidding him, especially by proposing the planting of colonies. 2. Son of the above, was also tribune, and though an opponent of the democrats, attempted to meet the Roman economic and political crisis in 93 to 92 B.C. by further agrarian reforms and foundations of colonies, as well as by proposing the enfranchisement of the Latin and Italian subjects of Rome. Probably on the latter account, he was assassinated in 91 B.C.

Drusus, NERO CLAUDIUS (38 B.C. to 9 A.D.), was the brother of the Emperor Tiberius. He extended the Roman sway in Germany to the Ocean and the Elbe, and received the title "Germanicus," which, however, is applied more particularly to his son. He was the father of the Emperor Claudius by Antonia, daughter of Mark Antony.

Druzes, a Syrian people, on the east slopes of Mount Lebanon, whence many have in recent years migrated to the Haurân uplands south of Damascus; they are of doubtful origin, but probably akin to the neighbouring Nazarihs, and like them practise certain mysterious rites supposed to be instituted in the 10th century by Hâkim, third Sultan of the Egyptian Fatimite dynasty, and afterwards propagated by Mohammed ed Derâzi, a Persian fanatic, who led his followers out of Egypt and established himself in the Lebanon; from him they take the name of Derûz or Drûz, and associate with him another Persian named Hamza, by whom their present code appears to have been formulated. They reject prayer, fasting, pilgrimage, eat pork and drink wine, and their claim to be regarded as Mohammedans is consequently rejected by the orthodox Mussulmans. They believe in one God, who has manifested himself several times, the last incarnation being that of Hâkim. There is also an esoteric or secret doctrine, revealed only to the okkâl (initiated), who meet once a week, but whose gatherings are supposed to be more of a political than of a religious character. The Druzes, who are an extremely warlike people, brave, intelligent, and physically superior to all the surrounding populations, have for ages been at feud with the neighbouring Christian Maronites [MARONITES], and towards the middle of the 19th century frightful massacres took place on both sides, leading to the intervention of the European powers. Since then peace has been maintained, and the Druzes, who have given a friendly welcome to the Protestant missionaries, have discontinued their warlike expeditions, devoting themselves to agriculture and other peaceful pursuits. They number altogether about 100,000, of whom the majority are now settled in Haurân. (Colonel Churchill, *The Druzes and the Maronites*, 1862; De Sacy, *Exposé de la Religion des Druzes*, 1838; Guy's *Théogonie des Druzes*, 1863.)

Dryad. [NATURE WORSHIP, NYMPH.]

Dryden, JOHN (1631-1700), an English poet (the "glorious John" of Claud Halcro in Sir Walter Scott's *Pirate*, was born of an ancient family in Northamptonshire. He was a King's scholar at

Westminster under the famous Dr. Busby, and a scholar of King's College, Cambridge. He came to London, and was secretary to his cousin, Sir Gilbert Pickering, and was a favourite of Cromwell, whose death gave occasion for his *Heroic Stanzas*. At the Restoration he became a King's man and wrote *Astræa Reducæ*. In 1661 he produced his first play, *Duke of Guise*, and in 1663 *The Wild Gallant*, which was not a success. In the same year he married Lady Elizabeth Howard, and collaborated with Sir Robert Howard to produce the *Indian Queen*—a tragedy on Montezuma, in heroic verse. This was followed by the *Indian Emperor*, which won great admiration. His *Annus Mirabilis* commemorates the year 1666, and in 1668 appeared his *Essay on Dramatic Poetry*, as well as *The Maiden Queen*. In 1670 he helped Sir William Davenant (q.v.) to produce a new version of Shakespeare's *Tempest*. He was appointed Poet Laureate and Court historiographer. He produced many pieces for the stage, and in 1681 appeared *Abalom* and *Achitophel* (Monmouth and Shaftesbury). In the *Medal* he attacked sedition, and in *Mac Flecknoe* satirised his brother poet Shadwell. Having become a Catholic in 1685 he wrote *The Hind and the Panther*, in defence of his new religion. He lost his offices at the Revolution, and it was in the following years that he did some of his best work. He translated (with Congreve) Juvenal, Persius, and the *Æneid* (1697). *Alexander's Feast*, and his *Fables*, which may be called translations of Boccaccio and Chaucer, are of this period. A keen satirist and writer of good prose and vigorous verse, he had a great influence upon his time. He was buried in Westminster Abbey. Scott wrote a good life of him in 1818, and Prof. Saintsbury has done so since.

Dryophis, a genus of arboreal innocuous colubriiform Snakes, the type of a family (Dryophidae) popularly called Whip Snakes, from their long, slender form. They are natives of tropical America, West Africa, and Madagascar, generally green in colour, and the snout is much prolonged.

Dryopithecus, an extinct genus of Anthropoid Apes from the Miocene of France. They were as large as gorillas; probably arboreal and frugivorous in habit, and, according to M. Lartet, their dentition was more man-like than that of any living Anthropoid.

Dry Pile, in *Electricity*, is a battery in which the liquid is replaced by some such substance as paper or leather that will absorb sufficient moisture to assist the chemical action. Instead of using a few cells, many hundreds are ranged one on the other in a column. In Zamboni's dry pile each cell consists simply of a disc of paper about one inch in diameter, silvered or tinned on one side and coated with a thin layer of black manganese oxide on the other. From one to two thousand of these are piled up so as to form a cylinder, which need not be greater than twelve inches in length. It is enclosed in a glass cylinder with a brass cap at each end making contact with the pile. Dry piles last for many years; they give no shock or spark, but are useful for charging condensers.

Dry Point. [ETCHING.]

Dry Rot, a disease in timber destroying its fibres into a mass of powder. In oak it is commonly produced by the mycelium or spawn of the fungus *Polyporus hybridus*; in coniferous wood by *Merulius laeprmans*, the growth of which is especially promoted by want of ventilation, and the presence of moisture and warmth. The careful selection of sound wood suitable for the purpose, leaving it, if possible, unpainted so as to allow air to pass through it, and careful seasoning, as by soaking in running water or in salt, are all recommended as preventives. The best, however, is creasote or heavy tar oil, which is forced into the wood at a temperature of 120° Fahr. under a pressure of 150 lbs. per square inch. A cubic foot of fir will absorb 8 to 10 lbs. of creasote. The creasote coagulates all the albuminoids in the wood. If the disease has begun, corrosive sublimate may be effectual in checking it.

Dual. In nouns, pronouns, and verbs in some of the Aryan and Semitic languages, besides the inflexions of the singular and plural, there is a third set, expressing the existence or action of two persons or things. This "dual number" is probably older than the plural, and usually is tending to disappear. In Sanscrit and ancient Greek it tends to disappear. In some dialects of the latter it is not found at all, and it had vanished altogether by the time of Alexander the Great. In Latin there is only one trace of it (in *ambo*, both), and it is not found in the Germanic languages.

Dualism. 1. In *Philosophy*, the recognition of two distinct conflicting principles or deities in the world. [MANICHEANS.] Christianity is not properly dualistic, as it regards the powers of evil as created and temporary. 2. In *Chemistry*, dualistic doctrines regarding the constitution of bodies largely prevailed during the early portion of the 19th century, chiefly through the influence of the Swedish chemist, Berzelius. Heregarded all elements as either electro-positive or electro-negative, and thought that compounds were always formed by the union of oppositely electrified atoms, such compounds being themselves positive or negative according to whichever kind of electrification was in excess. Two compounds could then unite with one another, but it was essential that one should be positive and the other negative. He supposed all salts to be formed by the union of two oxides—one an acid electro-negative oxide, the other a basic electro-positive oxide, and extended his dualistic ideas to substances other than salts or organic compounds. Acids were regarded as compounds of acid oxides with water, and hence all acids should necessarily contain oxygen. The proof of the existence of acids in which this element was not present, *e.g.* hydrochloric acid, HCl, prussic acid, HCN, was one of the first blows to these ideas. Another tenet of the theory was that no atom could take the place of an oppositely electrified atom in a compound. The discovery of compounds in which elements such as chlorine may replace hydrogen with but little alteration in the general properties of the

compound, *e.g.* in chloracetic acid, was in direct contradiction to the dualistic views and finally led to their overthrow and the formation of a type theory, which might be regarded as the foundation of the present system of chemical classification.

Duality, PRINCIPLE OF, in *Geometry*, means that many theorems relating to points and lines in one plane must exist in pairs. The reason may be briefly stated thus: a line is completely determined if we know two points on it, and may therefore be regarded as the product of those two points. If the points are named A and B, the line is named AB. Conversely, a point is completely determined if we know two lines through it, and may, therefore, be regarded as the product of those two lines. If the lines are named *a* and *b*, the point is named *ab*. Hence, three points determine three lines, and three lines determine three points. Corresponding to a series of points in a line, we should speak of a series of lines through a point. The correlation of lines and points being thus suggested, we may cite Pascal's theorem and its correlative, Brianchon's theorem, in illustration of the principle of duality. The former states that if six points be taken on any conic section, and a six-sided figure be drawn by finding six consecutive lines that are determined by these points, then the intersections or products of opposite sides of the figure will be three points in a line. The second may be deduced from the first by interchanging the words "line" and "point" throughout. Thus, if six lines be taken on any conic section (*i.e.* six tangents), and a six-pointed figure be drawn by finding six consecutive points that are determined by these lines, then the products of opposite points of the figure will be three lines through a point. In solid geometry the principle of duality similarly applies to points and planes, a plane being determined by three points and a point by three planes.

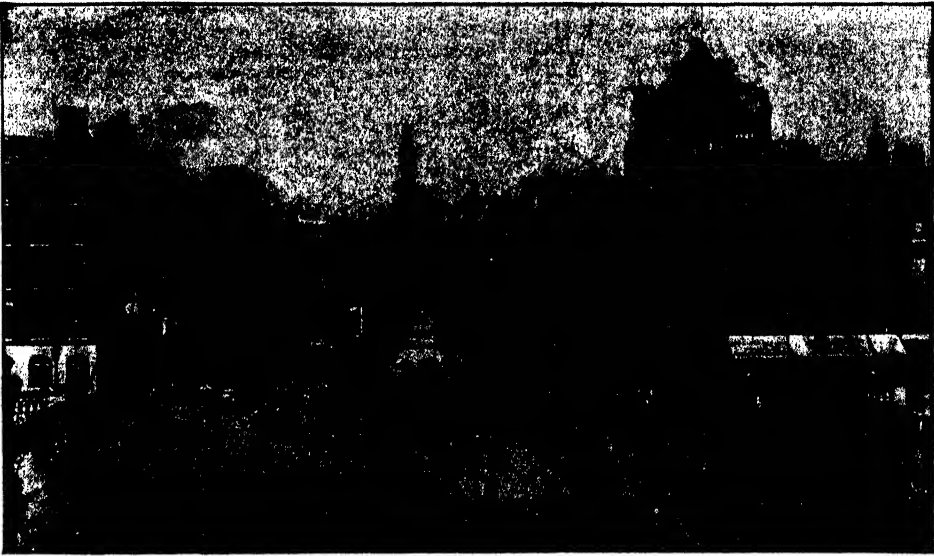
Du Barry, MARIE JEANNE, COMTESSE (1746-1793), a mistress of Louis XV., was born at Vancoeurs. Coming to Paris young, she became the mistress of Jean Du Barry, and was introduced to the king in 1769. He married her to the Count Du Barry, the brother of her former protector, as a cloak to his own connection with her. She ruled the king, and had great influence in the disposal of privileges and offices. After the death of the king she was sent to a convent, and received a pension from Louis XVI. She was guillotined during the Reign of Terror.

Dublin. 1. A county on the east coast of Ireland, in the province of Leinster, having a length of thirty-two miles, a breadth of eighteen, and an area of 354 miles, and a coast-line of seventy miles. Dublin Bay is the chief indentation. The Liffey flows from west to east, and the Royal and Grand Canals unite it with the Shannon. The surface is generally level, but in the south there are high lands rising to a height of 2,473 feet, and there is much picturesque scenery. The land is much divided, and nearly one-third is cultivated. The northern parts are level and tame, but fertile and beautifully green. There are many seats in the

southern parts. The country is not rich in minerals, nor are there many manufactures. Fishing employs a fair number of people. The county returns two members to Parliament. Pop. (1901), 447,266.

2. The capital of Ireland, is on the east coast of the county of Dublin, and within a mile of Dublin Bay, which is six miles across. The city is divided almost into halves by the Liffey, which flows into the bay, and the river embankments on either side form a magnificent line of quays through the city, though their beauty is somewhat marred by the foul state of the river. There is a harbour

corn exchange, the mansion house, and many other buildings, including many scientific institutions, hospitals, infirmaries, and barracks, and the city is well supplied with statues. The Royal barracks at the west accommodate 5,500 men. Besides St. Patrick's cathedral (1190) and Christ church (1038), there is a Roman Catholic cathedral and the fine church of St. George. Phoenix Park in the north-west, some distance up the Liffey, contains 1,759 acres, and is one of the finest parks in Europe. In it is the viceregal lodge, standing in its own grounds of 160 acres, and a Wellington



O'CONNELL (RACKVILLE) STREET, DUBLIN. (From a Photograph by Cassell & Co.)

between the North and South Walls, the latter of which runs out for three and a half miles and terminates in a lighthouse. There is also a harbour of refuge at Kingstown. The river is crossed by six stone bridges, three of iron, and one swing bridge. The old town is irregular, but the streets parallel to the Liffey and at right angles are regular. Most of the houses are brick. Two canals also pass through the city. The finest street is O'Connell Street, which is 650 yards long and 40 wide, and has in it a Nelson column and a statue of O'Connell. The O'Connell Bridge is of the same width as the street, and has a central footway. A railway connects the north and south, and there are four railway stations. The public buildings are very fine. On the east is the Castle, the official residence of the Lord Lieutenant. It dates from the 13th century, and has a fine Gothic chapel. East of the Castle is the Bank of Ireland, formerly the Parliament House, and at right angles to it is Trinity College, on the opposite side of College Green. The Four Courts are on the quay. Besides these there are the custom house, the Rotunda, the King's Inns, the post office, the

column. To the north of the park is Glasnevin cemetery, in which many renowned Irishmen are buried, among the latest being Charles Stewart Parnell. The chief industries of Dublin are brewing, distilling, and the manufacture of poplin. The city returns four members to Parliament. Dublin University was originally founded in 1320 and refounded in 1591. At present Trinity is its only college. This corporation consists of a provost, seven senior fellows and twenty-six junior fellows, and seventy foundation scholars. The fellowships are tenable for life, and the senior fellows are elected from among the juniors, who are appointed by the provost and senior fellows after examination. Degrees are granted by the senate of the University, subject to the consent of the College Board, and a right of veto exercised by the *caput* of the Senate—i.e. the chancellor, vice-chancellor, provost, and senior non-regent master, any one of whom may veto a degree. The college is administered by a board consisting of the provost and the senior fellows. In many features the college life resembles that of the older universities. Lever in *Charles O'Malley* gives us a

lively picture of the life in the early part of the century. There is a good library, which is yearly increasing under the provisions of the Copyright Act. The university returns two members to Parliament. Pop. (1901), 373,179.

Dubois, GUILLAUME, cardinal and prime minister of France (1656-1723), was born at Brive la Gaillarde. He was appointed tutor to the Duke of Chartres, who afterwards became regent. Like a celebrated head-master of later years he taught his pupil well, but took no heed of his morals; indeed, he is said to have encouraged him in vice to get a firmer hold on him. In 1692 he persuaded the duke to marry Mlle. de Blois, daughter of Louis XIV., and this added to his influence at court. He was appointed ambassador at the English court. He was addicted to wine, women, and play, but, as the king said to his traducers, he did not get drunk, get inveigled, or lose at cards. At the king's death the duke's mother exhorted her son to send off "ce fripon," but failed in the endeavour. In 1715 he was very powerful, in 1717 negotiated the Triple Alliance, in 1721 was cardinal, and the next year prime minister. But hard work and debauchery—burning the candle at both ends—at last killed him.

Dubovka, a Russian town in the province of Saratov, on the Volga. It has tanneries and a trade in mustard and salt.

Dubuque, capital of a county of the same name, in Iowa, United States, 198 miles north-west of Chicago. It is on the right bank of the Mississippi, and is partly upon bluffs 200 feet above the river, which is here crossed by an iron railway bridge. There are Roman Catholic and Episcopal bishops, and many churches, a city hall, a custom house, and a German Presbyterian seminary. It is the centre of the north-western lead region, and owes its name to a Frenchman who settled here for lead mining in 1788. It has some manufactures and considerable trade.

Du Cange, CHARLES DUFRESNE, SIEUR (1610-1688), a French historian and linguist, born near Amiens. He was educated at the Jesuits' College in Amiens, and then at Orleans and Paris. In 1631 he became a parliamentary advocate at Paris, and in 1645 royal treasurer at Amiens. In 1668 he came to Paris and devoted himself to literature. Among his works are *Glossaries of Greek and Latin of the Middle Ages and Modern Times*, *Historia Byzantina*, *Annals of Zonaras*, *Numismatics of the Middle Ages*. He has been called the French Varro, and was esteemed as much for his modesty and self-denial as for his high character and pure morals.

Ducat (Ital. *ducato*, belonging to a duke), a coin said by some authorities to have been introduced by Longinus, Exarch or Duke of Ravenna. According to Professor Skeat, it was first coined in the duchy of Apulia in 1140 B.C., and derived its name from an inscription on it, commending the duchy to Divine protection. The name was used in many European states for gold and silver coins down to the end of the first half of the 19th century. The gold ducats of Venice, also

called sequins or zecchini, were worth about 6s. About 1835 the German gold ducat, though slightly different in different states, was usually worth about 9s. 3d. Russia, Sweden, and Holland also had gold ducats, each worth about 8s. 4d., while Venice and Naples had silver ducats worth approximately 3s. 6d. (with silver at 5s. per oz.).

Duchesse, ANDRÉ, was born in the Touraine, France, in 1584, and from his boyhood showed a keen interest in archaeology and geography. His first work, published when he was eighteen, displaying considerable erudition, Richelieu became his patron, and made him historiographer to the king. Among his voluminous works may be mentioned *Les Antiquités et Recherches sur la Grandeur des Rois de France*, *Les Antiquités des Villes, Châteaux, etc.*, *Histoire d'Angleterre, d'Ecosse, et d'Irlande*, *Historie Normannorum Scriptores*, etc. He left a great mass of manuscripts, which served as materials for his son François, also an eminent antiquarian. Duchesne died in 1640, having been run over by a carriage in the neighbourhood of Paris.

Duchesne, LE PÈRE. [HERBERT.]

Duchesne, JEAN BAPTISTE JOSEPH, born at Gisors, France, in 1770, acquired a high reputation as a miniature painter, exercising his art until within a year or two of his death in 1856. He continued Petitot's series of enamels in the Louvre, and his portraits of Napoleon I., Louis Philippe, the Duchesses of Angoulême and Berry, and other historical personages, are highly interesting.

Duck, a book-name for any of one division of the Anatidæ, a family of Swimming Birds, containing the True Ducks, Geese and Swans. It is universally distributed; but the species are most abundant in temperate and cold climates, and one of the most important genera, economically, is Arctic. [EIDER DUCK.] In this family, which contains 40 genera with 180 species, the feet are very short, and the lower leg covered with a network of scales in front; the bill is almost straight, rounded at the extremity, and having the nostrils at the base; the hind toe, which is small and does not touch the ground, is present in all the species. When, as is sometimes done, the Flamingoes are included in the family, it is equivalent to the old group *Lamellirostræ*, so named because the beak is furnished on each side with a series of transverse plates which act as strainers to sift the mud in which these birds for the most part seek their food. In the type-genus *Anas* the legs are rather short, and placed centrally under the body; the wings are rather long and pointed, and the tail pointed or wedge-like; the sexes differ in plumage. The Mallard or Wild Duck (*Anas boschas*), widely distributed, is a British bird, still abundant, though its numbers have been reduced by the reclamation of the fen-lands. The male, about 24 inches long, is exceedingly beautiful. The head and upper part of the neck are deep emerald green; a white collar divides this from the brown of the lower part of the breast; the back is a mixture of black and brown, there is a bright-blue spot on each wing, and the central tail-feathers are

recurred. The female is somewhat smaller, and her plumage shades of brown. At the end of the breeding season the male assumes a dress much like that of his mate, recovering his brilliant appearance in the autumn. They frequent lakes and rivers feeding on aquatic vegetation and insects, molluscs and crustaceans, worms, frogs, and fish-fry. The nest is composed of grass lined with down, and contains about a dozen eggs. The wild species has a single mate, but when domesticated becomes polygamous. From this species all the varieties of the Domestic Duck are descended; but none has the fine plumage of the wild bird, the Rouen ducks approaching it most closely, while the Aylesburys are white and the Labradors black. [POULTRY.] Other British fresh-water ducks are the Gadwall, Garganey, Pintail, Shoveller, Teal, and Widgeon (all which see).

Duck Bill, Duck Mole. [ORNITHORHYNCHUS.]

Ducking Stool, or **CUCKING STOOL**, in mediæval England an instrument of punishment for scolding women. Strictly speaking, the delinquent was placed in a cucking stool at her own door as in a pillory, to be jeered at by the populace, or sometimes she was conducted round the town in it mounted on a handcart or *tumbrel*; while the ducking stool proper was a chair mounted at the end of a pole, which projected over a pond or river, and by a kind of seesaw arrangement allowed the victim to be dipped repeatedly until her passions had been cooled. One or other of these instruments was possessed by Derby, Chester (where it is mentioned in Domesday Book), Leicester, Gravesend, Cambridge, Banbury, and other towns. A woman was actually ducked in the ducking-stool at Chesterfield in 1790, and at Leominster in 1809. (See Jewitt in the *Reliquary*, vol. i.; 1860.)

Duckweed, or **DUCK'S MEAT** (*Lemna*), a curious genus of floating aquatic plants, represented by four British species, and forming the type of the order *Lemnaceæ*, which is related to the aroids. They have floating frond-like green stems, which reproduce themselves by buds. From their margins long simple roots with prominent root-caps hang down into the water. The flowers, somewhat rarely produced, are in a small spathe in a lateral notch on the stem, and consist of one or two stamens or of a single one-chambered one-seeded ovary, with no perianth. They are among the most minute of flowering plants.

Duckworth, **SIR JOHN THOMAS**, British admiral, son of a vicar of Stoke Pogis, was born at Leatherhead in 1749, and, having entered the royal navy, was present when only ten years of age at the victories of Boscawen and Hawke in 1759. He became a lieutenant in 1770, and as such took part in Byron's action in 1779, immediately after which he was made a commander. Promotion to captain followed in 1780. He was captain of the *Orion*, 74, at the battle of "the Glorious First of June," 1794, and of the *Lorient* at the attack on San Domingo in 1796. Three years later he was made a rear-admiral, and became second-in-command under Nelson at Naples. After rendering

various valuable services, and capturing a number of islands in the West Indies, he was so fortunate, on February 6th, 1806, as to fall in, off San Domingo, with a French squadron under Rear-Admiral Leissègues, and, after a warmly-fought action, to capture or destroy the whole of it except two frigates and a corvette. For this victory he received the thanks of both Houses, a pension of £1,000 a year, the freedom of the City, and other honours. He next became second-in-command, under Collingwood, in the Mediterranean; and in 1807 took his division of the fleet up the Dardanelles, engaging the Turkish batteries both going and returning. He was afterwards second-in-command in the Channel, commander-in-chief at Newfoundland, and port-admiral at Plymouth. In this last position he died in 1817, being at the time an admiral, a baronet, and a K.B. He was probably a brave and capable, but he was certainly a very unpopular officer, and it is to this latter fact that may be attributed the comparative smallness of the rewards which were given for his great services.

Ductility is a property of matter well illustrated by silver, copper, and other metals, which enables it to be drawn out into widely different forms. Copper-wire may be forced through a hole in a metal plate so as to be diminished in diameter while undergoing an extension of its length. The process may be repeated several times, providing that the metal is occasionally annealed so as to avoid the brittle condition. The power of changing shape without breaking when the material is subjected to percussion is called *malleability*, a property closely allied to ductility and illustrated by the same class of metals. By an ingenious process of wire-drawing a silver cylinder with a platinum core, Wollaston succeeded in obtaining platinum wire of exceeding tenuity; one mile of it only weighed 1½ grains.

Dudley, a parliamentary and municipal town in Worcestershire and Staffordshire, is the capital of the "Black Country." The ruins of the old castle, which is supposed to date from Saxon times, and is mentioned in Domesday Book, connect it, like many other thriving industrial centres, with the feudal past. In 1585 Sir Amyas Paulet described the town as being the poorest he had ever seen. It was not until the middle of the 18th century that the discovery of coal and iron in close proximity awoke the place to new prosperity, and conferred vast wealth on the owners of the soil, the Wards of Bixley, who were soon admitted to the peerage as Barons and Earls of Dudley, a title to which they had some claim through marriage with the heiress of its original possessors. Dudley is on the Great Western Railway, about 8 miles N.W. of Birmingham, and is a fairly well-built but not attractive town, containing the usual public buildings, institutions, churches, etc., all of them modern. Besides coal-mining and iron-working, the chief manufactures are nails, machinery, chains, fire-irons, tools, and glass. There are also brass foundries, brickfields, tanneries, and breweries. The borough returns one member to Parliament. Pop. (1901), 48,809.

Duelling. The practice of duelling is still very prevalent on the Continent, but it is now rare in Britain, a challenge to fight being punishable with fine or imprisonment, or both; and it has been long since decided that no words of provocation, however aggravating, can justify it. Duelling had its origin in the trial by battle which was common in early times, jointly with the single combat or tournament of the age of chivalry, which itself owed its existence to the early trial by battle. This was regarded, according to the superstitious notions of the time, as a certain means of ascertaining and determining the guilt or innocence of a person charged with a crime, or of adjudicating a disputed right. It was thought that the Almighty took care to see that in every case justice was done and innocence vindicated. The trial by battle was introduced into England by William the Conqueror, and established in three cases, viz. :—(1) In the court-martial or court of chivalry; (2) in appeals of felony; (3) in civil cases upon issue joined in a writ of right. Once established as a mode of trial, the duel was retained after the superstition which had given rise to it had passed away, and was resorted to for the purpose of wreaking vengeance or gaining reputation by the display of courage. Then came the age of chivalry with its worship of punctilio and personal prowess, its tilts and tournaments; and the duel, originally a mode of trial established by law, became a practice dependent on fashion or conventional notions of honour. The trial by battle in appeals of felony and writs of right was only abolished in the year 1819. The law of England makes no distinction whatever between the killing of a man in a duel and other kinds of murder, and the seconds of both parties are also guilty of murder. Further, where no mischief actually ensues from the meeting it may amount to felony as an attempt to murder. By regulations promulgated in the year 1813, duelling in the army is prohibited under severe penalties. In France attempts were made to check it by legislation in 1892.

Duff, REV. ALEXANDER, born at Pitlochrie in 1806, and educated at St. Andrew's, where he came under the influence of Dr. Chalmers, took an early interest in missionary enterprise, and in 1829 sailed for India as the first pioneer sent by the Established Church of Scotland into that field. He perceived that education must necessarily precede conversion in the case of a race like the Hindus, and his efforts were largely directed towards the establishment of schools and colleges, with which his name will always be associated. In 1843 he joined the Free Church, pursuing under its banner the same policy. In 1851 during a holiday at home he was elected Moderator, and his views were freely incorporated into the Education Despatch of 1854. His health broke down in 1863, when he accepted a professorship in the Free Church College, Edinburgh, dying in 1878. Besides several valuable works on educational and missionary subjects, he published an interesting book on *The Indian Rebellion: its Causes and Results*, and was for some years editor of the *Calcutta Review*.

Duff, JAMES CUNNINGHAM GRANT, an eminent

Indian soldier and statesman, was born at Banff in 1789, being the son of Mr. John Grant of Kincardine O'Neill. He assumed the name of Duff from his mother, who inherited the property of an uncle, Mr. Duff of Eden. He joined the Bombay army at the age of 16, and after winning military distinction, especially at the siege of Maliah, became Mountstuart Elphinstone's right-hand man in the subjugation of the Mahratta chiefs. The discharge of this duty led him to Sattara, the centre of the confederacy, where he was the first British resident, and he succeeded in establishing satisfactory relations between the warlike tribes and the East India Company's Government. His health broke down under the strain of anxious work, and, returning to his native country, he died at Eden in 1858. His son, the Right Hon. Sir Mountstuart Elphinstone Grant Duff, born in 1829, after a long parliamentary career, became Under-Secretary of State for India in 1868, and for the Colonies in 1880. He went out next year as Governor of Madras, and resigned in 1886.

Dufferin, THE RIGHT HON. FREDERICK TEMPLE HAMILTON-BLACKWOOD, K.P., G.C.B., G.C.S.I., G.C.M.G., G.C.I.E., Marquis of Dufferin and Earl of Ava, only son of the fourth Irish Baron Dufferin, was born in 1826, and educated at Eton and Christchurch, Oxford, succeeding to his father's title in 1841. On his mother's side he was descended from the famous wit and politician, Richard Brinsley Sheridan. In 1846-7 he visited the famine-stricken districts of Ireland, and wrote a valuable account of all he saw. For some years he was a lord-in-waiting, but in 1855 began his diplomatic career by accompanying Lord John Russell in his mission to Vienna. In 1861 he became Under-Secretary for India, being transferred to the War Office in 1866. On the accession of Mr. Gladstone to power in 1868 he joined the administration as Chancellor of the Duchy of Lancaster and Paymaster-General, resigning those posts in 1874 to go out as Governor-General to Canada, the duties of which office he fulfilled up to 1878. He had only been at home a few months when he was appointed to the embassy at St. Petersburg, where he remained only two years, succeeding Sir H. A. Layard at Constantinople in 1881. Before the end of 1884 he proceeded to Calcutta as Governor-General of India. The annexation of Burma was more or less successfully accomplished under his auspices, and the exploit received its reward and commemoration in the addition of "Ava" to the title of the marquise conferred upon him in 1888. On leaving India he took over the embassy at Rome, until the death of Lord Lytton in 1892 gave him the still more important post of British representative at Paris. In 1896 he retired from the diplomatic service. His amusing *Letters from High Latitudes* (1859) are well known. He was made Lord Warden of the Cinque Ports in 1891. Lord Dufferin married, in 1862, the eldest daughter of Captain Archibald Rowan Hamilton, and had a numerous family. To Lady Dufferin was due in no slight degree the social distinction that marked her husband's career. He died in 1902.

Duffy, THE HON. SIR CHARLES GAVAN, K.C.M.G., was born in co. Monaghan, Ireland, in 1816. At the age of twenty he became sub-editor of the *Dublin Morning Register*, and in 1842, in conjunction with the Young Ireland party, helped to found the *Nation*, contributing to it his well-known articles on "The Ballad Poetry of Ireland." In 1844 he was convicted with O'Connell of sedition, but the conviction was quashed on appeal. Three years later O'Connell seceded from the movement, and Duffy, attaching himself to Smith O'Brien, took an active part in forming the Irish Confederation. In 1848 he was tried for treason-felony, and acquitted, and in 1852 won the seat of New Ross against Sir Thomas Redington, the Under-Secretary for Ireland. The comparative failure of the Tenant League and the Independent Irish party inspired him with disgust for parliamentary life. He resigned in 1856, emigrated to Australia, and resumed his profession as a barrister at Melbourne. He soon plunged into Colonial politics, entered the Victorian Legislature, and became Minister of Public Works in 1857, and of Lands in 1858 and 1862, devoting his abilities to the work of federalising the Australian Colonies. In 1871, after two years' holiday in Europe, he held the Premiership for a few months, but resigned the next year, having succeeded, however, in bringing about a conference of all the Australian governments, which resulted in obtaining large concessions from the mother country. He was knighted in 1873, again passed some years at home, and returned in 1876 to accept the Speakership of the Legislative Assembly, when the distinction of K.C.M.G. was bestowed upon him. In 1880 he returned to England, and published an interesting record of his early experiences under the title of *Young Ireland*, which was followed up in 1883 by *Four Years of Irish History*. He died in 1903.

Duffa. [DAFLA.]

Dugdale, SIR WILLIAM, the descendant of an old Lancashire family, was born at Shustoke, near Coleshill, Warwickshire, in 1605. Marrying at the early age of seventeen, and succeeding to his paternal estates in 1624, he settled down as a country squire at Blyth Hall, devoting himself to those antiquarian studies that had attracted him from his boyhood. He was collecting materials for a history of Warwickshire when a visit to London brought him into contact with Sir Henry Spelman, the Earl Marshal, Lord Arundel, and Sir Christopher Hatton. He received a post in the Herald's Office, and began to lay the foundations of his great work *Monasticon Anglicanum*, making careful drawings, too, of the chief churches in England, the existence of which was threatened by Puritan zeal. In 1641 he joined Charles I. at Oxford, and spent his next four years in a curious alternation between military duties and archaeological research. After the surrender of Oxford he resumed his task in London, with Dods-worth's help, and begun the publication of the *Monasticon* in 1655. At the Restoration he was appointed Norroy King-at-Arms, and in 1677 succeeded to the more important office connected with the Order of the Garter. He died at his

Warwickshire home in 1686. We owe to him a *History of St. Pauls, a Baronage of England*, and other minor works, besides his autobiography and the great monument of industry with which his name is associated.

Dugong, any species of the Sirenian genus *Halicornes*. The head is rounded and joined to the fish-like body by a short neck, and the snout is bent downwards; the digits of the anterior and only pair of limbs are nailless, and the tail is broad and deeply notched. The upper jaw bears two tusk-like incisors, which persist in the male and point downwards and forwards, but remain in the alveolar cavities in the female; canine teeth are absent, and there are five or six molars in each jaw. According to Prof. Flower, the size of these animals is greatly exaggerated, a length of eight feet being rarely exceeded. These primitive marine mammals frequent the bottoms of shallow bays and creeks feeding on marine vegetation. The female is an excellent mother, and produces a single calf at a birth. The way in which the young are suckled, by holding them to the teats, almost in human fashion, possibly gave rise to the mermaid myth which is commemorated in the generic name (= sea-maiden). There are three species, *H. tabernaculi*, which owes its specific name to Rüppell's fancy that it furnished the "badger" skins for the covering of the tabernacle (Exod. xxv. 5); *H. dugong*, from the Indian and Pacific Oceans, and *H. australis* from the Australian coasts. This last species yields an oil said to possess the medicinal qualities of cod-liver oil without its disagreeable taste and smell. [MANATEE, RHYTINA, SIRENIA.]

Duguay Trouin, RÉNÉ, the most celebrated of French privateers, was born at St. Malo in 1673, and after leading a very irregular life, embarked in 1689 in a privateer frigate belonging to some of his relatives. In 1691 he was given a ship of his own, and almost immediately landed on the coast of Clare and burnt a couple of vessels. In 1692 he obtained a commission from the ex-king of England, James II., and at once became very successful. He afterwards commanded several French men-of-war that had been lent by Louis to be used as privateers, and in the *Diligente*, 36, he was captured in 1694 by an English squadron. But he speedily broke away from Plymouth, where he was detained, and resumed his cruises, this time at the head of a squadron of privateers. He made some handsome prizes, and fought several most creditable actions with men-of-war and Indiamen. These exploits brought him into favour with the king. He gained further successes against the Dutch, and was in 1697 adopted into the French royal navy with the rank of frigate-captain. Upon the resumption of war in 1702 he continued his brilliant services, was ennobled in 1709, and was raised to flag rank in 1715. In 1726 he was made lieutenant-general (vice-admiral), and in 1736, older in honours than in years, he died.

Duisburg, a walled town in Westphalia, N. Germany, situated on a canal connected with the

Rhine, about 15 miles N. of Düsseldorf. Its population is engaged in ship-building and the manufacture of silk, woollen, and cotton fabrics, as well as soap, leather, starch, and tobacco. It possesses an observatory and gymnasium, but the university was abolished in 1802 after an existence of 150 years.

Duke (Latin *dux*, a leader or general). The Roman Emperor Constantine divided the military and civil functions of provincial governors the better to keep them in subjection, and appointed commanders-in-chief (*magistri*, masters) of cavalry and infantry, under whom were district commanders (*duces*), some of whom had the title of *comites* (counts). The German tribes used the term to translate their own word *heretoga* (Germ. *Herzog*), leader of the army. The Franks (q.v.) divided Gaul into districts, whose commanders were *duces* or *comites*, several of the latter being sometimes grouped under one of the former. Charles the Great redivided his empire similarly. After his death, however, the office became hereditary, and was formally recognised as such in 877. The Exarchs of Ravenna, too, appointed dukes over the cities of North Italy. The rank has existed in every nobility of Europe. It was not introduced into England till 1337, when Edward III. created his son, the Black Prince, Duke of Cornwall. It need hardly be said that with the growth of great centralised monarchies the rank, which originally was official, became disconnected from any special duties (save those of a peer) in England and France, and that the duke need have little or no connection with the place whence he takes his title. In both countries it is the highest rank of the nobility. For a time in the reign of Elizabeth it was in abeyance in England. Princes of the blood are often created dukes with us. Other dukes, as also duchesses, are addressed as "Your Grace" and styled "Most Noble." Their eldest sons, by courtesy, rank as Marquises, and bear their father's second title. Their other sons are "Lords" by courtesy, and their daughters "Ladies" (e.g. Lord Randolph Churchill, Lady Diana Beauclerk). The ducal coronet has eight golden leaves (commonly called "strawberry leaves") arranged in a wreath on a circlet of gold, which contains a crimson velvet cap, with gold tassel, and lined with ermine. Dukes in the Scottish and Irish peerage, of course, do not sit in the House of Lords as such, but in right of English (usually inferior) titles. In France, before the Revolution, some dukes were peers of France, some were dukes by letters patent (of these dignities there were two kinds), and some dukes for life only, while the three first were hereditary. Abolished at the Revolution, the title was revived by Napoleon I., and dukes were created under the restored Bourbon and Orleanist monarchies and the Third Empire. Of course, the rank is now merely titular. In Germany, as formerly in Italy, the title of Duke or Grand Duke is borne by the sovereign or semi-sovereign potentates. Austrian Archdukes and Russian Grand Dukes are members of the reigning families. The title of duke is similarly restricted in Sweden and Denmark.

Dukinfield, a township in Cheshire, about 1½

mile S. of Stalybridge, and on the Manchester and Stalybridge Railway. Cotton-spinning and coal-mining give employment to a large and scattered population. Pop. (1901), 18,929.

Dulce Domum, the Latin school song of Winchester College, sung on the last six Saturdays of the summer half by the school before the traditional "walk to Hills" (St. Catherine's Hill, near the town). The legend is that some three centuries ago a friendless scholar was left in College alone during the holidays. Unable to bear the solitude, he carved the words "Dulce Domum" on a tree, and died of a broken heart. The song has been often translated. It need hardly be said that *dulce domum* does not mean "sweet home."

Dulcigno (classic *Olcinium*; Turk. *Olgun*), a seaport on the Adriatic, about 18 miles S.W. of Scutari. It formerly belonged to Turkey, but was transferred to Montenegro by the Berlin Treaty of 1878. Built on a promontory and defended by a castle, it was for many years a stronghold of pirates, but the inhabitants are now engaged in the coasting-trade or agriculture.

Dulcimer, a four-sided stringed instrument with a sounding board, played by striking the strings with small hammers. It is the prototype of the pianoforte, but owing to the absence of any contrivance for checking the vibrations of one note before another is sounded ("damping"), the effect is somewhat blurred. It is probably of Oriental origin, and is now used only by the Hungarian gipsies.

Dulcite, or **DULCITOL**, is a crystalline substance which is obtained from an unknown Madagascar root, and occurs in a few other plants. It has the composition $C_6H_8(OH)_6$, being a hexahydric alcohol isomeric with mannite. It forms monoclinic crystals slightly soluble in water, and possesses a sweet taste. It may also be artificially prepared by the action of sodium upon milk, sugar, and galactose, to which substances it is closely related chemically.

Dulong and Petit's Law, in chemical *Physics*, was discovered by these experimenters in 1819. The law states that for most elements the specific heat multiplied by the atomic weight gives a constant number. This number is about 6.2 as the following table shows, the differences actually obtained being readily accounted for by experimental errors. The constant is known as the *atomic heat* of simple substances.

Element.	Specific Heat.	Atomic Weight.	Atomic Heat
Zinc - - -	.0955	65	6.2075
Iron - - -	.1188	56	6.6728
Tin - - -	.0462	118	6.6316
Copper - - -	.0951	63.5	6.0289
Lead - - -	.0314	207	6.4998
Silver - - -	.0570	108	6.1560
Gold - - -	.0324	196	6.3504

Neumann and Regnault found that all compound bodies of similar atomic composition follow the

same sort of law, though the actual constant varies in different types of compounds.

Dulse, a name applied to several edible seaweeds. In Scotland it is *Rhodymenia palmata*, known to the Icelanders as the "sugar fungus." *Laurencia pinnatifida* affords an inferior kind known as Pepper Dulse. In the south-west of England dulse is *Iridaea edulis*. These plants all belong to the Florideæ or red sea-weeds.

Duluth, a port on Lake Superior, North America, in the state of Minnesota, U.S.A. It derives its name from a French explorer, and has rapidly risen of late years, being the point of junction between the Northern Pacific Railway and the Mississippi line that connects the town with St. Paul, distant 150 miles to the S.W. Duluth stands on the sloping shore of the lake, from which it is approached by a broad ship-canal. There are docks, warehouses, and manufactories, and a large trade is done in corn, timber, and other western products.

Dulwich, once a hamlet in the parish of Camberwell, Surrey, $4\frac{1}{2}$ miles from St. Paul's Cathedral, has now grown into one of the most thriving and populous of southern suburbs. The manor in 1606 passed into the hands of a tragic actor, Edward Alleyn (q.v.), who founded there the famous College of God's Gift on the lines of St. Paul's school and Westminster. For nearly two centuries his charitable intentions were frustrated; but in 1858 the public conscience awakened, and the foundation was restored by Act of Parliament. The institution, which comprises an Upper and a Lower School, is now most flourishing. The Picture Gallery attached to it derived its origin in the bequest of Sir Francis Bourgeois, R.A., in 1811. Therein are exhibited some Murillos, as well as notable examples of the chief Italian and Flemish schools. The district being hilly, picturesque, and salubrious, is covered with villas and humbler residences, and for ecclesiastical purposes is divided into East and South Dulwich. Pop. (1901), 10,246.

Dumas, ALEXANDRE, the Elder, was the son of General Dumas, a Creole, sprung from the union of the Marquis de la Pailletterie with a black woman of St. Domingo. Born in 1802 at Villars-Cotterets, his physical and moral nature showed strong traces of his grandmother's blood, though his own mother was of French race and exercised a very salutary influence upon his character. Having lost his father at the age of four, he seems to have led a rather desultory life until 1823, when poverty compelled him to seek his fortune in Paris. A small place in the Duke of Orleans' household enabled him to keep body and soul together whilst he turned his ambitious energies towards dramatic literature. After producing one or two lighter pieces, he resolved, under the influence of a mere casual glimpse of Shakespeare's genius, to introduce naturalism upon the French stage. His *Henry III.*, the starting-point of the Romantic school, proved a decided success in 1829, but the Revolution, into which Dumas plunged recklessly as an opponent of the monarchy, caused its withdrawal. *Antony* in

1831 added to his reputation, though grossly immoral, and *La Tour de Nesle* in 1832, a brilliant plagiarism, enjoyed a long run. Down to 1860, when *La Dame de Monsoreau* appeared, he constantly recurred to the historical drama, in which his best faculties are displayed, *La Reine Margot*, *Mlle. de Belleisle*, *La Jeunesse de Louis XIV.*, and *Le Mariage sous Louis XV.* being the chief of his sixty pieces. In 1832 the *Révue de Deux Mondes* began to publish some of his romances, in which he had for model the works of Scott, then beginning to find appreciation in France, and a temporary expatriation led him to compile his *Impressions de Voyage* and other books on travel, most of the matter being appropriated from previous writers, though the treatment of it is original enough. Indeed, this remark holds good of nearly all his literary productions. The climax of his fame was reached on the publication of *Monte Cristo* in 1844, followed next year by *Les Trois Mousquetaires*. This was the period of his most extraordinary fecundity, when about forty volumes a year was his regular output. It was, of course, physically impossible that he should write or even dictate this prodigious mass of stuff. He employed a number of journeymen, to whom he gave his instructions as regards plot and treatment, correcting their productions before going to press. The chief of this staff was Maquet, who was said to have been the real author of the best of the stories; but what he published under his own name will not bear comparison with the work that bears the signature of Dumas. In 1842 he contracted an unhappy marriage with an actress, Ida Ferrier, and they began together a career of extravagance, which was continued after they parted, as they soon did. Dumas was now in receipt of an enormous income, which he spent in a reckless fashion, building a theatre for himself and a palatial villa, besides indulging every whim of the hour. He accompanied the Duc de Montpensier to Spain in 1846, and indulged in a trip to Algeria and Tunis at the expense of the Government. The Revolution of 1848 saw the beginning of his decline, though he contrived to spend money for twenty years longer. In 1860 he joined Garibaldi, and almost succeeded in bringing Italian patriotism into ridicule. From this time forth he led a hand-to-mouth existence, engaging in any scheme that might furnish him with money to squander, and degrading his old age by his connection with Adah Menken. Ill-health, poverty, and decay of intellect marked his closing years. In 1870, at the outbreak of the war, he was taken to Puys, near Dieppe, where he lingered until the end of the year under the assiduous care of his son and daughter. His remains were transferred in 1872 to Villars-Cotterets, his native town. Braggart, plagiarist, and epicurean as he was, it is impossible to feel unkindly towards him, or to forget that his talents did much towards breaking down the absurd conventionality that had since the epoch of Louis XIV. impeded the development of French literature.

Dumas, ALEXANDRE, the Younger, son of the foregoing, was born in Paris in 1824. He received

a good education, accompanied his father to the Mediterranean in 1846, and made his *début* as a novelist with *La Dame aux Camélias* in 1848. This rather morbid product of sentimentalism was clever enough to establish at once its author's reputation; but it hardly gave an idea of his true character, which in every respect offers a strange antithesis to that of his father. *Le Demi-Monde* (1855), *La Question d'Argent* (1857), *Les Idées de Madame Aubray* (1867), *La Visite de Noces*, *La Princesse Georges* (1871), *Monsieur Alphonse* (1873), *L'Étranger* (1876), and *Les Danicheff* (1876) are among his most successful dramas. After the war of 1870 and the Commune, he wrote several powerful letters to the press on the social aspects of French politics, and his ethical theories have found expression in the prefaces to his published plays and in *La Lettre d'un Provincial*. Of his novels, which are far less powerful than his dramatic productions, *Le Roman d'une Femme* (1848), *Antonine* (1849), *Diane de Lys* (1851), *La Dame aux Peites* (1854), *L'Affaire Clémenceau* (1867), *Les Femmes qui mentent et les Femmes qui volent* (1880), *La Princesse de Bagdad* (1881), and *Franoillon* (1887), have been the most successful. M. Dumas received the Legion of Honour in 1867, and was admitted to the Academy in 1875. He died in 1895.

Du Maurier, GEORGE LOUIS PALMELLA BUSSON, whose French grandparents settled in England during the Reign of Terror, was born in Paris in 1834. In 1851 he came over to England, and for a time studied chemistry at University College, London, but soon returned to Paris with a view to making art his profession. After some years in the *atelier* of M. Gleyre, and in the schools of Antwerp and Düsseldorf, he started as a designer of wood engravings in London, working first for *Once a Week*, then for the *Cornhill Magazine*, and finally joining the staff of *Punch*, of which he was a member until his death. He illustrated, moreover, Thackeray's *Esmond*, and *Ballads*, Jerrold's *Story of a Feather*, Foxe's *Book of Martyrs*, and Mrs. Gaskell's *Wives and Daughters*. It is, however, through his clever and genial sketches, ridiculing the foibles and phases of English society, that he is best known. A series of his *Punch* drawings was published in 1880, and many of them were exhibited in 1885. In 1891 he published a novel, *Peter Ibbetson*, followed in 1894 by *Trilby*, which immediately achieved extraordinary popularity, particularly in America. It was dramatised, and met with great success in that form.

In 1896 Du Maurier suddenly died. His last work, *The Martian*, was published posthumously in 1897.

Dumbarton, the capital of Dumbartonshire, is a royal, parliamentary, and municipal borough and port situated at the junction of the rivers Clyde and Leven, 14 miles N.W. of Glasgow. The Romans had a naval station here known as *Theodosia*, which, under the name *Alcluyd*, became the capital of the British kingdom of Strathclyde. Later on the town passed into the hands of the Earls of Lennox, who transferred it to Alexander II., when it was erected (1221) into a royal burgh,

with the privilege of levying certain tolls on the Clyde navigation. This right was maintained until 1700. The town occupies a semicircular site along the east bank of the Leven, which forms a commodious harbour, and a handsome stone bridge connects it with a suburb on the opposite shore. The basaltic rock of Dumbarton, shooting up to a height of over 200 ft., and crowned by a strong castle, commands the port. Since the decay of the glass factories, iron-shipbuilding has become the chief industry, and engages thousands of hands, the Dennystown Forge Company being the principal employer of labour. In conjunction with Kilmarnock, Renfrew, Rutherglen, and Port Glasgow, the borough returns one member to Parliament. Pop. (1901), 21,000.

Dumbartonshire, anciently Lennox or Levenaux, is in the W. of Scotland, between the Clyde Estuary S., Perthshire N., Stirlingshire and Lanarkshire E., Loch Long and Argyllshire W. It is cut in two by a part of Lanarkshire, the north portion being twice as large as the other. The total area is 154,542 acres, of which the lower districts along the Clyde and Leven are remarkably fertile whilst the upper tracts to the north contain Ben Voirlich, Ben Vane, and some of the finest scenery in Scotland, besides yielding building stone, slate, iron ore, and coal. Large numbers of cattle and sheep are pastured on the hills. The coast line extends for 35 miles on the west side, and Loch Lomond stretches for 20 miles to the east, so that the county has always enjoyed facilities for water-carriage. These were augmented in 1775 by the opening of the Forth and Clyde Canal, and since 1850 several railways have been constructed. Calico-printing, bleaching, and dyeing, are carried on in the valley of the Leven, and factories for spinning and weaving exist at Duntocker, Milton, and elsewhere. Among the chief towns and villages are Datmuir, Renton, Bonhill, Cardross, and Kirkintilloch, the port of Bowling, and the watering-places of Helensburgh, Kilcreggan, and Roseneath. Rob Roy's country lies in the north, and legends of Wallace and Bruce abound in other quarters. Pop. (1901), 113,626.

Dumbness. This condition may exist in connection with deafness developing in infancy [DEAF and DUMB], or may be due to disease of the brain [APHASIA]. It is sometimes met with in lunatics, and is of not unfrequent occurrence in hysterical conditions. In the last-named condition the infirmity is only transitory as a rule, and is usually amenable to treatment.

Dumfries, the capital of Dumfriesshire, a royal, parliamentary, and municipal borough and river port, stands on the left bank of the Nith, eight miles from the Solway Firth, and 33 miles N.W. of Carlisle. The date of its origin is uncertain. It was made a royal burgh by William the Lion, took a strong part on Balliol's side in the wars of the early 14th century, was for two and a half centuries mixed up in the frequent border forays, having a close union first with the Douglasses and then with the Maxwells of Caerlaverock. It was opposed to the Union, but loyal to the Hanoverians, for which

reason the Young Pretender exacted a requisition in 1745. No Scottish town has made more rapid progress during the last fifty years. Always possessed of a good market as the centre of a rich agricultural and pastoral district, it has of late taken a prominent part in the tweed and hosiery trades, in the growth and sale of nursery produce and timber, in leather-making, and in the working of iron. The chief interest in the place outside the commercial sphere is due to its connection with Burns, who lies buried in the churchyard of St. Michael's. The stone bridge built by Devorgilla, mother of John Balliol (1280), is a remarkable structure. The town has schools, hospitals, lunatic asylums and other public institutions. With Annan, Kircudbright, Sanquhar, and Lochmaben, it returns one member to Parliament. Pop. (1901), 18,148.

Dumfriesshire, one of the Scottish border counties, is bounded on the S. by Cumberland and the Solway Firth, on the N. by Lanark, Peebles and Selkirk, on the E. by Roxburgh, and on the W. by Ayr and Kircudbright. It has a length of 50 miles by a breadth of 32 miles, with an area of 1,103 square miles. The whole county sweeps down with an irregular slope from the mountainous northern boundary to the Solway Firth, on which it has a coast-line of 21 miles. The valleys of the Nith, the Annan, and the Esk form three natural divisions, each of from 40 to 50 miles in length, and of increasing fertility as the lower levels are reached. Farming is carried to a high pitch of perfection, and sheep-breeding, cattle-dealing, and pork-curing add to the resources of the district, which can only boast of rich coal mines and lead mines in the N.W., quarries of lime and sandstone, even alluvial gold, some woollen factories, and excellent salmon-fishing. Sanquhar, Lochmaben, Lockerbie, Langholm, Annan, and the Spa of Moffat are the places of chief importance; whilst Ecclefechan is famed as the birthplace of Carlyle, and Greta Green, on the Cumberland border, was the scene of runaway marriages till 1856. As the home of many great border families, Dumfriesshire is dotted over with numberless ruined castles. The Caledonian main line traverses the northern half of the county, and the Glasgow and South Western line passes through the southern portion. Pop. (1901), 72,571.

Dumont, PIERRE ÉTIENNE LOUIS, was born at Geneva in 1759, and being early left fatherless had to work even as a schoolboy for his own support and that of the family. In 1781 he was chosen one of the pastors of the city, but political troubles drove him into exile, and after a short stay in St. Petersburg he came to London as private tutor to Lord Shelburne's children. Here he soon allied himself with the advanced Whigs, and acted as French editor, so to speak, to Bentham for many years. He visited Paris in 1788 and 1789, making the intimate acquaintance of Mirabeau, whom he helped in the management of his paper, *Le Courier de Province*. Returning to England, he lived at Lansdowne House or Bowood, and was a frequent guest at Holland House, thus meeting all the most eminent thinkers and writers of Europe. In 1814 he resumed his

residence in his native city, where he soon became the leader of the Supreme Council, devoting himself especially to legal reforms. He died in 1829 at Milan, whilst on a holiday excursion. His *Souvenirs sur Mirabeau* appeared in 1832.

Dumont d'Urville, JULES SÉBASTIEN CÉSAR, was born at Condé-sur-Noireau, in Normandy, in 1790, and at the age of seventeen went to sea as a probationer in the French navy. He soon made his way in this career, and used his leisure to such purpose as to become master of several sciences and languages. In 1820, whilst surveying the Mediterranean, he discovered the Venus of Milo. In 1822 he served under Duperrey, and three years later, as captain of the *Astroble*, he sailed in search of La Pérouse, returning with valuable geographical information as to the southern hemisphere. His famous voyage in the South Polar Sea was begun in 1837; it resulted in the discovery of Joinville Island, Louis Philippe Land, Adélie Land, and in more exact knowledge of the Pacific groups and the Eastern Archipelago. He had scarcely been a year at home when he was killed (1842), with his wife and son, in a railway accident near Versailles. His works include descriptions of his voyages, a summary of Magellan's travels, and an account of the flora of the Greek islands and the Black Sea.

Dumouriez, CHARLES FRANÇOIS, was born of a good Provençal family in 1739, and when eighteen accompanied his father, a commissary of the army that invaded Hanover during the Seven Years' war. He distinguished himself, and won a captaincy, but on the reduction of the strength had to retire, when he was employed in secret, having a decided bent for diplomacy. In Corsica, Poland, Sweden, and elsewhere, he was engaged in intrigues not only for the French Government, but on his own account, and as a consequence passed the last years of Louis XIV.'s reign in prison. On his release he pointed out the value of Cherbourg as a harbour, and in 1778 was made governor there. An advocate of reform without abrogation of the monarchy, he was looked upon with high favour by the Girondists in 1788; and having for a brief period acted as a Minister for Foreign Affairs and for War, he was sent under Marshal Luckner to command the Army of the North. His success over the Allies at Valmy (1792) was followed up by a brilliant campaign in the Austrian Netherlands. Early in 1793 he was defeated by Coburg at Neerwinden, and being accused of treachery by the agents of the Convention, from whom the execution of the king had alienated him, he went over to the Austrian camp. After many wanderings he settled in England in 1804, and enjoyed a pension from Government. At the Restoration he was slighted by the Bourbons, nor did he ever return to France, dying at his own house near Henley-on-Thames in 1823.

Dünaberg is a town in the government of Vitebsk, European Russia, built on both sides of the river Dwina, 12 miles S.E. of Riga. It possesses a first-class fortress, commanding a floating-bridge over the river, and from its position on the railway between Warsaw and St. Petersburg is of great

military and commercial importance. There is a large trade in hemp, flax, tallow, and timber, and the local industries include tanning, brewing, brick-making, etc. The town was founded originally by one of the orders of Teutonic knighthood in 1278. It was acquired by Poland in 1559, but was soon after taken by Ivan the Terrible. The Swedes held it for a short time in the 17th century, and the French under Macdonald captured it in 1812.

Dunbar, a royal, parliamentary, and municipal burgh and port, in the county of Haddington, Scotland, occupies an elevated site on the mouth of the Firth of Forth, about 29 miles N.E. of Edinburgh, with which city it is connected by the North British Railway. The castle, now in ruins, was a famous stronghold in the middle of the 9th century, and the town was made a royal burgh by David II. After the defeat of Balliol (1296) it was taken by Edward I., and Edward II. took refuge there in his flight from Bannockburn. Black Agnes of Dunbar, Countess of March, defended the place against Salisbury in 1337, and it often served as a retreat to Mary Queen of Scots. The castle was destroyed by the Regent Murray in 1567. Cromwell routed the Scots at "the race of Dunbar" in 1658. Among other relics of antiquity are the ruins of the Grey Friars convent, and the mansion of the Lauderdales. On the site of the old collegiate church stands the modern parish church, with a lofty tower that serves as a landmark. Herring fishery and shipbuilding are the chief industries, but there are a few foundries, distilleries, and breweries. The harbour, once limited and shallow, and always difficult of access, has been improved of late years. In conjunction with Haddington, Jedburgh, Lauder, and North Berwick, Dunbar returns one member to Parliament. Pop. (1901), 3,581.

Dunbar, WILLIAM, was born in Lothian, Scotland, about 1460, being of the family of the Earls of March. In 1477 he graduated at St. Andrew's, and appears to have become a preaching Franciscan. Before the end of the century James IV. employed him on diplomatic missions, and from the year 1500 he was a pensioned servant of the king and "rhymmer of Scotland." He visited England on the marriage of his master with Princess Margaret, and he received a present from Henry VII., probably for *The Thriissil and the Rois*, a poem commemorating that event. We have about a hundred of his compositions, most of them short, but showing a good deal of imagination, high descriptive powers, and an exuberant humour that is occasionally unintelligible and not seldom coarse. *The Golden Targe* is a serious allegory of high aim, but wearisome. *The Dance of the Seven Deadly Synnes*, a weird and grotesque performance, has the merit of originality. *The Precious of Berynk* and *The Two Maryit Women and the Wedo* follow Chaucer pretty closely, whilst *The Flyting of Dunbar and Kennedy*, being hardly comprehensible, though full of strongly-flavoured expressions, has been very popular in the north. After the battle of Flodden the poet disappears from view, but is supposed to have lived until 1520, or even a few years later.

Dunbird. [POCHARD.]

Duncan, the King of Scotland immortalised in Shakespeare's *Macbeth*, succeeded his grandfather Malcolm II. in 1033. Investigations would seem to indicate that the dramatist's masterpiece, like many other great works, is based on a posthumous libel. Macbeth's father had been killed by Malcolm, as had also the grandfather of Lady Macbeth, whose real name was Gruoch, and their joint claim to the throne was stronger than Duncan's. The struggle was carried on until 1039, when Duncan was defeated and killed at Bothgowan near Elgin. [MACBETH.]

Duncan, ADAM, VISCOUNT, British naval officer, younger son of Alexander Duncan, of Lundie, was born at Dundee in 1731, and entered the royal navy at the age of 12. He took part in the expeditions against Rochefort and Goree, and, having been posted in 1761, was Keppel's flag captain at the reduction of Belleisle and at the operations against Havana. He shared in Rodney's relief of Gibraltar, and, in command of the *Monarch*, distinguished himself in the action with *De Langara* in 1780. He also shared in Howe's relief of Gibraltar. In 1787 he became a rear-admiral, and in 1793 a vice-admiral. In 1797, after having most bravely quelled a mutiny on board his flagship, the *Venerable*, in Yarmouth Roads, he put to sea with two ships, the only ones of a mutinous fleet that would accompany him, and, in spite of his small force, blockaded the Texel for several months. Being then reinforced, he met the Dutch fleet, which had, during his temporary absence, ventured out, and on October 11, 1797, most crushingly defeated it off Camperdown, capturing eight ships of the line. For this great service he was rewarded with a barony and viscounty, a pension of £3,000 a year, the thanks of both Houses, the freedom of the City and a sword of honour. Lord Duncan, whose character was one of the noblest and most amiable that has adorned the navy, was a man of extraordinary strength and physique, and particularly handsome. He died, universally lamented, on August 4, 1804.

Duncan, THOMAS, born at Kinclaven, Perthshire, in 1807, was destined for the law, but, having a taste for art, became a pupil of Sir William Allan, the eminent Scottish painter. He acted for many years as Professor of Colouring in the Trustees Academy, Edinburgh. His first important picture, *The Young Pretender entering Edinburgh after Prestonpans*, won him the associateship of the Royal Academy in 1843. *Charles Edward sleeping after Culloden* was exhibited in that year, and in the next appeared *Cupid* and *The Martyrdom of John Brown of Priesthill*. He died young in 1845, leaving a number of excellent portraits that testify to his skill.

Dundalk, a port and parliamentary borough in co. Louth, Ireland, situated in Dundalk Bay, at the mouth of the Castletown river, 50 miles N. of Dublin, and on the North of Ireland Railway. It was a royal city in the reign of Edward II. Edward Bruce was proclaimed king there in 1315, and was killed in a battle close by. The place was

taken by the Irish in 1641, by Cromwell in 1649, and by Schomberg in 1689. The parish church has a curious copper-covered steeple of wood, and the Roman Catholic church has some architectural pretensions. There are the usual public buildings of a county and assize town. The chief trade is in agricultural produce, but flax-spinning, iron-founding, distilling, brewing, and salt-making, are also carried on. The harbour has undergone much improvement, and a railway has been constructed to Greenore on Carlingford Lough, so that regular steam traffic is now maintained, and the exports of grain and live stock are greatly increased. Dundalk returned one member to Parliament until 1885, but is now merged in the county. Pop. (1901), 14,308.

Dundas, SIR DAVID, was born in Edinburgh, of good Scottish family, about 1735, entered the army in 1752, and in 1759 accompanied Colonel Elliot, afterwards Lord Heathfield, to Germany. Three years later he followed the same officer to the West Indies, obtaining command of a cavalry regiment after twenty years' service. An experience of the Prussian military system under Frederick the Great induced him to write two works on tactics and drill that were for a time adopted in our army. At Toulon (1793), in Holland under the Duke of York (1794), and again in the disastrous expedition of 1799, he fought with distinction. He became successively Quartermaster-General, Governor of Chelsea Hospital, and Commander-in-Chief in succession to the Duke of York (1809). He died in 1820.

Dundas, HENRY, VISCOUNT MELVILLE, belonged to the Arniston branch of the same family as the foregoing, and was born about 1740. After an education received at the High School and University of Edinburgh, he entered the profession of the law, of which his father and many other relatives were distinguished members. Such was his ability that in 1775 he had attained the position of Lord Advocate, and was returned to Parliament as member for the county of Edinburgh. He passed over from the Opposition to the Ministry, and was appointed by Lord Shelburne in 1782 treasurer of the navy. This office he resumed under Pitt on the fall of the Coalition, and he remained closely associated with that statesman until 1801, acting for ten years as Home Secretary. At Pitt's return to power in 1804 he became First Lord of the Admiralty, having in the meantime been created Viscount Melville and Baron Dunira in the interregnum of Addington. He was charged in 1805 with being concerned in the application of public money to speculative objects by his agent, Mr. Trotter, and to Pitt's great sorrow he was compelled to resign. A subsequent trial resulted in his acquittal, when he was restored to the Privy Council, but not to office. He died in 1811. His son and successor became First Lord of the Admiralty under Wellington in 1828.

Dundas, THE HON. SIR RICHARD SAUNDERS, British naval officer, was second son of Viscount Melville, and was born in 1802. He became a commander in 1823 and a captain in 1824, and in the latter capacity served with credit in China in 1841. In 1853 he was made rear-admiral, and in 1855 he

commanded the Baltic Fleet against Russia. He died a vice-admiral in 1861. Admiral Sir James Whitley Deans Dundas, who was a son of Dr. James Deans, of Calcutta, and who was born in 1783, assumed the name of Dundas on his marriage in 1808. He was commander-in-chief in the Mediterranean, and, during the early part of the Russian war, in the Black Sea, and he died in 1862. He was not related to the officer above-mentioned.

Dundee. [CLAVERHOUSE.]

Dundee, a royal and parliamentary burgh and port in Forfarshire, on the N. shore of the Firth of Tay, and about 12 miles from the German Ocean. It is an ancient town, and is said to have been called Alectum, but the first mention of its existence is in a deed of about 1200 A.D. William the Lion made it a royal burgh, and here Wallace was born and began his struggle for independence. Dundee was twice taken by the English in the reign of Edward I., again in that of Richard II., and a fourth time under Edward VI. Adopting with fervour the principles of the Reformation, it was sacked by Montrose in 1645 and by Monk in 1651, when a sixth of the inhabitants were put to the sword, and an immense amount of plunder was carried away. Though it then ranked as the third town in Scotland for population and higher still for wealth and strength, its great prosperity only dates back a century, when steam-power was first applied to the spinning and weaving of flax, hemp, and jute. Other sources of wealth are whale-fishing, shipbuilding, leather-dressing, boot-making, and confectionery, the factories of Messrs. Keiller and Sons being among the largest in the kingdom for the production of jam and marmalade. The docks cover an area of 35 acres. Most of the antique public buildings have disappeared, but the Old Steeple, restored by Sir G. Scott, Dudhope Castle, now converted into barracks, the old Custom House, and a part of the venerable walls, from which Wishart the martyr preached in 1544, still remain. Among modern structures are the Town House by Adam, the Albert Institute (Gothic), by Sir G. Scott, the High School, by Angus, the Royal Arch, commemorating the visit of the Queen in 1844, the Royal Infirmary (Tudor), the Morgan Hospital, the College and the free library. There is a fine esplanade on the river, and half-a-dozen public parks, of which the chief are named after Baxter and Balcay. The water supply derived from Loch Lintrathen is excellent. The North British and Caledonian Railways formerly approached the town by a circuitous route, but in 1878 the famous Tay Bridge was opened. Next year this costly work was destroyed during a storm, a terrible loss of life ensuing. A more secure viaduct now spans the estuary, and forms one of the noblest monuments of engineering skill. Pop. (1901), 160,871.

Dundonald, THE HON. THOMAS COCHRANE, sometime Lord Cochrane, and afterwards tenth EARL OF, a very brave and distinguished naval officer, was born in 1775. He entered the service in a nominal capacity in 1780, but did not actually go to sea until 1793, having previously been gazetted to a captaincy in the 79th Foot. In 1795,

as acting lieutenant of the *Thetis*, 42, he contributed to the capture of two French men-of-war; in 1799 he took part in a very gallant boat action off Gibraltar; and in 1800 he was made acting-captain of the French prize *Généreux*, 74. He was in the same year made commander in the sloop *Speedy*, 14, in which he executed some of the most daring exploits in our naval history. Particularly celebrated is his action with, and capture of, the Spanish frigate *Gamo*, 32, in 1801. The *Speedy* herself was afterwards taken by a French squadron, but Lord Cochrane was speedily exchanged, and posted for his successes. He next distinguished himself in the *Pallas*, 32, and *Impérience*, 44. While commanding the latter he led the attack upon the French shipping in Basque Roads on April 11, 1809, and for this most heroic service he was made a K.B. In 1814 certain charges, which were afterwards proved to be utterly false, were preferred against him, and he was deprived of all his professional rank and honours. He thereupon assumed command successively of the insurgent navies of Chili, Brazil, and Greece, behaving everywhere with the highest heroism and resource and gaining special glory by his marvellous capture of the Spanish frigate *Esmeralda*. In 1830 Lord Cochrane was reinstated in his place in the British navy; in 1831 he succeeded to the family peerage; and in 1847 the Order of the Bath was at length restored to him. He had become a vice-admiral in 1841, and became an admiral in 1851. In 1860 he died. His lordship published most interesting accounts of his adventurous and honourable life, and his *Autobiography of a Seaman* should be read by every English-speaking boy.

Dunedin, the capital of the district of Otago in South Island, New Zealand, was founded in 1848 by the Lay Association of the Free Church of Scotland. It stands at the head of the harbour of Otago, on the S.W. shore, about 18 miles from the sea, and Port Chalmers, 9 miles lower down, affords anchorage for the largest vessels, while large sums have been expended in rendering Dunedin itself accessible. Regular steamers run to Melbourne and to all the New Zealand ports, and the coasting trade is very considerable. The city is beautifully placed, well-built, and surrounded by pleasant suburbs. It contains the University of Otago, free libraries, schools, churches of all denominations, a provincial council hall, supreme court, and all the other buildings of an administrative centre. The public gardens are particularly fine. In 1861 the settlement received a great impulse from the discovery of gold, but the prosperity of the colonists, who are mainly Scots, is based upon the enormous development of the wool trade, and upon the growth of the shipping interest.

Dunes, heaps and ridges of sand, or less commonly of finely powdered calcareous matter, piled up by the action of winds. They are chiefly found on windward coasts, but also inland, as in the Sahara, Arabia, Utah, and Arizona. They travel in parallel ridges often of considerable height, such as 50 or 60 feet in Norfolk and in Holland, where, however, they sometimes reach

260 feet high over a belt reaching five miles in breadth. They often dam back streams forming pools, salt-marshes, or extensive swamps, as along the coast of Gascony, and, if not arrested, may travel inland from 3 to 24 feet annually, as on the Danish coast. Owing to the destruction of good land thus brought about, they have been planted with the sand sedge (*Carex arenaria*) with running stems, or better still, as to the south of Bordeaux, with the cluster pine (*Pinus maritima*), which is a valuable source of timber and turpentine, besides binding the sands with its roots and breaking the force of the wind. Dunes, 100 to 200 feet high, occur on the south-east of Lake Michigan, and those east of the Caspian have deflected the Oxus into the Sea of Aral. Long parallel lines of high dunes traverse the deserts of central Australia. In Cornwall, the Bahamas, and Bermudas the fine-grained material is largely the comminuted remains of nullipores (q.v.), a group of algae encrusted with carbonate of lime, and this substance is often cemented by percolating waters into a compact stone.

Dunfermline, a very ancient city and royal burgh in the W. of Fifeshire, Scotland, 16 miles N.W. of Edinburgh, with which it is connected by two lines of railway, and three miles from the Firth of Forth at Limekilns. Standing 300 feet above the sea, it is cut in two by a deep ravine or "linn," from which it takes its name, "the fort on the crooked linn." It is irregularly built, with narrow and tortuous streets. The ruins still exist of the old palace where the kings of Scotland often resided as early as the 10th century. Charles I. is said to have been born here, Charles II. having been the last royal occupant. Edward I. held court in the Benedictine Abbey, of which portions, built by Malcolm Canmore in the 11th century, are in use at present. The tomb of Bruce lies below the pulpit of the new church, erected on the site of the abbey chancel. The modern public buildings are excellent, and include public baths, the gift of Mr. Andrew Carnegie, a wealthy American citizen and a native of the place. The manufacture of damask and table-linen is the chief industry, but there are collieries, iron-foundries, soap-works, and other undertakings. Together with Stirling, Inverkeithing, and Culross, Dunfermline returns one member to Parliament. Pop. (1901), 25,250.

Dunganis (TUNGANIS), a historical people scattered over various parts of Mongolia and the western provinces of China (Kansu, Shensi, Szechuen), and numerous especially in Zungaria. The term Dungan, i.e. "Converted," is applied in a general way to all the Chinese Mohammedans (the Shui-Shui, or Hui-Hui of Chinese writers); but it indicates more particularly the mixed Mongolo-Chinese Mohammedans of the western regions, who now form a special type distinguished by large muscular frames, arched nose, oblique eyes, and somewhat fair complexion. They appear to have been originally of Tatar stock, and they themselves claim descent from the Uigur Tatars removed to the vicinity of the Great Wall during the Thang dynasty (7 to 10 centuries of new era). All are now

Mussulmans of Chinese speech, and those of Zungaria rebelled against the Chinese Government in 1864, when they exterminated all the officials, and rapidly occupied the Ili valley and the Tian-Shan region as far as Urumsai. But in 1867 the Taranchis of Chinese Turkestan, wearied with their exactions, rose against them, killed large numbers, and drove the rest into the territory of Kulja, at that time held by the Russians. Since then most of the Dungánis have returned to Zungaria, where by crossings with the Taranchis and Kirghiz they have developed a type quite distinct from the Chinese. The Dungánis, taking the word in its wider sense, are estimated to number about 30 millions altogether. (Prjewalski, *Mongolia*, vol. ii.; Schuyler, *Turkestan*, vol. ii.; Ch. de Ujfalvy, *Bulletin* of the French Geographical Society, 1878 and 1879.)

Dung Flies, a group of flies that live on dung, on which they feed and in which they bury their eggs, so that the larvæ may at once obtain a supply of suitable food. The best known English species is the "yellow downy dung fly" (*Scatophaga stercoraria*, Linn.).

Dunkirk, or DUNKERQUE, "the church on the dunes or sandbanks," is a fortified port in the department of Nord, France, 43 miles N.W. of Lille. According to tradition, it owes its origin to a chapel founded by St. Eloi in the 7th century, and was raised to the rank of a town by Baldwin III. in 960. The English burned it in 1388, and later on occupied it, being driven out in 1558 by the French, who in turn surrendered it to the Spaniards. In 1646 it was again captured and soon afterwards restored, but in 1658 Turenne wrested it from Spain, and gave it to England. Charles II. sold it for £200,000 to Louis XIV. The Duke of York besieged it in vain in 1793. Dunkirk has a military as well as a commercial harbour, and though the entrance is shallow and difficult there is safe anchorage in the roads. The docks cover 100 acres, and a large import and export trade is done. The Dunkirk boats take a considerable part in the herring and cod fisheries. The growth of beetroots and the manufacture of sugar afford occupation to much of the population, but ship-building, iron-founding, distilling, and the making of soap, starch, and salt are important industries. There are many churches, the chief being that of St. Eloi, rebuilt in 1560. The Beffroi or signal tower, with a fine peal of bells, the modern *Palais de Justice*, the pictures in the Exchange and elsewhere, and the statue of Jean Bart by David d'Angers, deserve to be noticed.

Dunlin (*Tringa alpina*), an active British sand-piper, called also Parre, Stint, Ox-bird, and Seasnipe, common on shores and about tidal rivers, feeding on small crustaceans, insects and worms, and retiring inland to breed. The male, which is slightly smaller than its mate, is about eight inches long, but these birds vary greatly in size, coloration, and in the length of the bill. The summer plumage is black above with rusty grey and white markings; throat light grey, a black horseshoe-like mark on the breast, and the rest of the lower surface white. In winter the upper surface is much lighter, and the under surface is white.

Dunmow, GREAT, a market-town in Essex, on the Great-Eastern Railway, 11 miles N.W. of Chelmsford. Its incorporation dates from Philip and Mary. On the opposite or left bank of the river Chelmer stands Little Dunmow, within which was situated a priory, where in the reign of John was started the strange practice of presenting a slice of bacon to any married couple that could prove they had spent the first year of their union in perfect happiness and concord. A jury of bachelors and spinsters had to decide upon the claim, which was only successfully established five times between 1445 and 1753. Mr. Harrison Ainsworth drew attention to the custom in one of his novels, and it was revived in 1855 at Great Dunmow, being still kept up there by casual enthusiasts. At Whichnor in Staffordshire, St. Meleine in Brittany, Vienna, and elsewhere a similar usage seems to have prevailed. Pop. (1901), 15,705.

Dunnoch. [HEDGE SPARROW.]

Dunnottar, a town on the coast of Kincardineshire, Scotland, 16 miles S.E. of Aberdeen, and forming part of the seaport of Stonehaven. On a rock that rises abruptly from the sea to a height of 160 feet stands Dunnottar Castle, once the abode of the Keiths, Earls Marischal, alleged to have been founded in the 7th century. During the Commonwealth the Scottish regalia were preserved here, and after the Restoration the stronghold was used for the imprisonment of Covenanters. It was dismantled in 1720. Dunnottar House is situated about a mile inland.

Dunois, JEAN, "the Bastard of Orleans," was born at Paris in 1402, being the natural son of the Duke of Orleans and Mariette d'Enghien, Madame de Cury. Recognised and educated by his father, he early distinguished himself in the war against England, and in 1428-29 joined Joan of Arc in defending Orleans and in the victory of Patay. Seven years later he entered Paris in triumph, having raised the siege of the capital as well as of Chartres and Lagny. He was mainly instrumental in driving the English inch by inch out of the Ile de France and Normandy. He then instigated Louis XI. to rise against his father, but made up for his disloyalty by expelling the English from Guienne and Bordeaux. For these great services he was legitimated by Charles VII., created Grand Chamberlain, and loaded with honours, of which Louis XI. deprived him. He next took part in the league against that monarch, but, playing the part of a mediator in the quarrel, was restored to his former dignity, and died in 1468.

Duns Scotus, JOHN, was born after the middle of the 13th century, but neither the precise date nor even his nationality has been ascertained. He joined the Franciscan order, became a fellow of Merton College, Oxford, and in 1301 was appointed professor of philosophy in that university. His lectures appear to have been immensely popular. At the end of three or four years he proceeded to Paris, where he took a doctor's degree, and became regent of the school of theology in 1307. His contest with the Dominicans and their leader,

Thomas Aquinas, as to the doctrine of the Immaculate Conception, won for him the title of Doctor Subtilis, and led to the long-standing opposition between Scotists and Thomists. Both were realists, but Scotus and his disciples held that all knowledge was based on revelation, whilst Aquinas recognised reason as an intellectual factor. The former maintained both the freedom of the will and the doctrine of predestination, the latter making the will dependent on the understanding and other antecedent causes. Hence a distinction between the two schools as to the theory of divine grace. Duns Scotus was invited to Cologne in 1308 for the purpose of establishing a university, but he died of apoplexy before the close of the year. He left a number of works which have been printed with apocryphal additions. The most valuable of his remains consist of commentaries on Aristotle.

Dunstable, a market-town in Bedfordshire, 33 miles N.W. of London, on the North-Western and Great Northern Railways. Being placed at the point where Watling Street and Icknield Street meet, it was probably a Roman station, but the first historical proof of its existence dates from 1110, when, according to Matthew Paris, the religious play, *St. Katharina*, was acted there. The Augustinian Priory, of which the existing parish church formed part, was founded in 1131, and for centuries a feud raged between the canons and the burghers as to the lordship of the town. The *Annales de Dunstaplia*, extending to 1297, afford a most valuable record of contemporary events. The richly-decorated west front of the parish church, the monuments of the Chew family and Thornhill's *Last Supper* inside the building, and the Ashton schools are the chief objects of interest in the town. Straw-plaiting employs most of the population, in which the female element largely preponderates. A charter of incorporation was granted in 1864. Pop. (1901), 5,147.

Dunstan, ST., was born at Glastonbury, about 924, of a family reputed to share royal blood. A Bishop of Winchester was his uncle. He displayed in his youth great abilities, and was taken into the household of Athelstan, where his clerical skill, musical accomplishments, and popularity with the ladies raised up many enemies. Driven from court on suspicion of sorcery, he resolved to take the tonsure, and, being restored to the favour of Edmund, was made, at the age of 22, Abbot of Glastonbury and treasurer to the king. The weakness of Edred strengthened Dunstan's position, so that on Edwy's accession in 955 he attempted to control him as he had his predecessor. The story of the young king's love for Elgiva, daughter of Ethelgiva, and of Dunstan's interference, belongs to the romance of history, nor is it possible to appreciate fairly the points at issue. Ethelgiva ultimately succeeded in driving Dunstan to seek refuge at Ghent, but he soon returned to assist Edgar in wresting the kingdom from his brother and in effecting the pacification of Northumbria, for which he was rewarded with the Archbishopric of Canterbury. He placed the crown on Edward's

head, though it is alleged that he got rid of the opposition in the Witan by a mechanical miracle, which caused half of the floor of their meeting-place at Calne to collapse during the debate. His influence appears to have diminished under Ethelred the Unready, and he is reported to have withdrawn from public business to spend his last years in prayer, music, and the making of bells and other tuneful instruments. He died in 989. It is not easy to separate the false from the true in the legendary accounts that have come down to us. His personal conflicts with the Devil, whose nose he pulled with red-hot pincers, are recorded with as much gravity as his more statesmanlike exploits. He appears to have been a broad-minded ecclesiastic, whose influence on his age was decidedly beneficial, and whose death was certainly followed by national disaster. It is extremely doubtful whether any of the works assigned to him are authentic.

Duodecimals, in arithmetic, an old system for the determination of areas and volumes of rectangles and rectangular prisms respectively, when their linear dimensions are given in feet and inches.

Dupanloup, FELIX ANTOINE PHILIBERT (1802-1878), a French prelate born at St. Félix, near Chambéry, in Savoy. He was brought up by his uncle, a country priest, and went when quite young to Paris. In 1821 he entered the seminary of Issy, and was ordained in 1824. Having been appointed vicar of the Madeleine, he made a great impression by his eloquence, and his further nomination as confessor of the little Duke of Bordeaux, and later of Talleyrand, brought him more into notice. His style of preaching has been described as "limpid as a blue sky," but "brilliant and cold." He was a member of the Sorbonne in 1841, and shortly afterwards he went to Rome, where he was fêted and made much of. On his return to France he came forward as the champion of Catholicism, and was the moving spirit of the paper *Ami de la Religion*, which acted as the counterpoise to the erratic *Univers*. He was made Bishop of Orleans and member of the Educational Commission, and distinguished himself by vigorous opposition to the campaign that was being fought against the classics as part of the regular course of education. In 1854 he was elected an Academician. He was a great champion of the Pope's temporal power, but was opposed to the dogma of Infallibility, though of course, when it was declared, he acquiesced in it. During the Franco-Prussian war he displayed great patriotic feeling, and in 1871 he became deputy for Orleans. He was devoted to the poor, and an enthusiast in education.

Dupleix, JOSEPH FRANÇOIS, MARQUIS (1697-1764), a French statesman and famous governor of the French East Indies, was born in Hainault, of which province his father was farmer-general. At the age of 18 he went to sea, and made voyages to America and India, where he remained. In 1720, by means of the influence he was able to command, he was war-commissary and member of the Superior

Council of the French colony. As governor-general he encouraged trade and developed Chandernagore, besides getting a footing in Patna. In his projects he was greatly aided by his wife, who was skilled in Oriental languages and customs, and together they succeeded in establishing a preponderating French influence throughout the Carnatic. When in 1746 war broke out with the English East India Company, Duplex and La Bourdonnais would perhaps have crushed the Company could they have agreed together. Duplex fortified Pondicherry, and defended it when besieged. After the peace he was recalled—to please England, it is said—and the Government refused to make good the private fortune he had expended in defending their possessions. Had Duplex had his hands free it is possible that he might have made India a French empire.

Duplicate Ratio, of two numbers, means the ratio of their squares. Thus the duplicate ratio of the numbers 5 and 6 is not 5 : 6, but 25 : 36. The duplicate ratio of two straight lines is the ratio of the areas of the squares described on them. This ratio is of importance in the theory of similar plane figures, for it is proved in geometry that the ratio of the areas of two such figures is equal to the duplicate ratio of any corresponding linear dimensions. If one square has its diagonal twice as great as that of another square, its area will be four times that of the second. If the diameters of two circles are in the ratio of 3 to 4, their areas will be in the ratio of 9 to 16. The same rule applies to any pair of similar plane figures. In the case of similar solids we find their volumes are in the triplicate ratio of corresponding linear dimensions—i.e. proportional to their cubes. Thus, if the diameters of two globes are in the ratio of 1 to 2, their volumes will be as 1 to 8.

Dupuis, CHARLES FRANÇOIS (1742-1809), a French man of letters, was the son of a village schoolmaster in the department of Oise. At 11 years old he attracted by his talent the Duke of Rochefoucauld, who put him to college. At the age of 24 he was professor of rhetoric at Lisieux. He was a good Latinist, and two of his discourses were much admired. He studied under Lalande, and published in 1781 a memoir on the origin of the constellations. His anti-religious spirit brought him into some disrepute; but it brought him to the notice of Frederick the Great, who invited him to Berlin, but he died before the invitation could be accepted. In 1787 he was professor of eloquence at the Collège de France, and in the Revolution he was a member of the Five Hundred and president of the Directoire Exécutif. His chief work was *Religion Universelle* (1795), in which he spoke much of Upper Egypt as the cradle of religion.

Dupuy de Lôme, STANISLAS CHARLES HENRI LAURENT, French naval engineer, was born in 1816 at Ploemeur, near Lorient. Between 1848 and 1852 he built the first screw line-of-battle ship, the *Napalm*, and in 1859 the first armour-plated battleship, the *Gloire*. He had in the meantime been appointed inspector-general of the navy. In

his later life he conducted many interesting aeronautical experiments, and invented a balloon which possessed a certain extent of steering-power. His death occurred in 1885.

Duquesne, ABRAHAM, French admiral, was born at Dieppe in 1610, and is best known as the rival of the great De Ruyter in 1676. In 1672 he commanded part of the French fleet that should have co-operated with the English at the battle of Solebay; but he allowed personal jealousies on that occasion and on many others to interfere with his duty. He distinguished himself by bombarding Tripoli in 1681, Algiers in 1682, and Genoa in 1684. Although a Protestant, he was, on account of his services, excepted from the proscription that resulted from the revocation of the Edict of Nantes in 1685; but as the exception extended only to him, and not to his children, who were banished, the last days of the old seaman were greatly embittered. He died in 1688.

Duran, CAROLUS, a French painter, was born in 1837 at Lille. After studying in Paris, in Rome, and in Spain, where he was considerably influenced by the paintings of Velasquez, he exhibited in 1866 *L'Assassine*, for which he received a medal. He afterwards devoted himself to portrait-painting, among his most successful portraits being one of his wife and one of Madame Leydeau (1870).

Durango, called also Ciudad de Victoria, a town of Mexico 500 miles N.W. of Mexico, founded in 1559, and situated on a plateau 6,700 feet above sea-level. It is well built, and has a cathedral, mint, theatre, tramways, and telephones. The state of the same name is traversed by the Sierra Madre, and has an area of 54,000 square miles. Some iron and nickel of supposed aerolitic origin is found.

Durâni, the largest and most powerful division of the Afghân nation, and since 1747 the political rulers of the country, occupying the whole of the Helmand Valley between Kandahar and Herat, and also the Kabul district as far as the foot of the Hindu-Kush. Two main divisions, *Ārak*, with four branches; Popalzai, Barakzai (the royal sept since 1818), Alikiozai and Achakzai; *Panjpas*, with five branches: Nurzai, Alizai, Ishakzai, Khugiani, Maku, with nearly 150 clans altogether and total population about 850,000. The Abdali, as they were formerly called, took the name of Durâni in 1747 when Ahmad Khan, on the death of Nadir Shah, founded the present Afghân State and assumed the title of *Dur ed Durân*, "Pearl of the Age." Thanks to their closer contact with Persia, the Durâni were always distinguished above the rest of the nation, and even above the Ghiljis, who were the ruling branch before them, by a higher degree of culture and a more elevated sentiment of national dignity. The Ghiljis themselves, despite their hereditary jealousy of the present rulers, recognise the superiority of the Durâni above all the divisions of the Afghân people. The Durâni have a special veneration for Kandahar, which, though not the present capital, is regarded by them as the cradle of their race. (Ferrier, *History of the Afghâns*, 1857; Thornton, *Gazetteer*, 1844;

Leech, *Account of the Abdaless in Journal of the Asiatic Society*, 1845.)

Durazzo (in Turkish *Dratsch*; Slav *Drus*; the Greek *Epidamnus* and Roman *Dyrrhachium*), a port of Albania, on the Adriatic, 50 miles S. of Scutari. The port is sitting up, and the fortifications are in ruins. A Corcyrean colony at Epidamnus brought about the Peloponnesian war by getting into conflict with their parent city in 426 B.C. In Roman times the town was an important stage on the road to Greece, and is associated with the history of Cæsar and Pompey.

Durban, the port of Natal situated almost at the intersection of the 30° S. latitude and 31° E. longitude, is on the northern shore of a bay almost enclosed by the land. The climate, though hot, is healthy and suitable for Europeans, who form nearly half of the population. There are some good public buildings, and fair roads with sidewalks, and the town is supplied with water from the river a few miles away. There are Town and Botanic Gardens, two parks, and a race-course; a tramway of 4½ miles leads through the main street, and to the European quarter on some low hills overlooking the town, and the government railway to the interior has its terminus here. The town was founded by the Dutch, who had a republic here till 1842. There is an inner harbour of 4,700 acres, and 27 feet deep, and a new breakwater has been constructed. In 1895 the railway was extended to Johannesburg and the Transvaal, and greatly increased the prosperity of Durban. During the war against the Boers (1899-1902) it was the port of entry for troops and supplies.

Duren (the Roman *Marcodurum*), a Prussian town on the right bank of the Roer, 16 miles N.E. of Aix-la-Chapelle, a stone bridge crossing the river. The industries are steel and iron, woollen, paper, and leather manufactures, and there is a trade in corn and cattle.

Durer, ALBERT (1471-1528), a noted German engraver and painter, was born at Nuremberg. His father was a goldsmith, and would have brought up his son to the same calling, but the latter displayed a decided taste for painting, and entered the studio of Michel Wohlgemuth. He then travelled in Germany, the Netherlands, and Italy, and in 1494 came home and married, and three years later produced a portrait of himself and a notable engraving from the nude. In 1506 he was again in Italy, where he engraved and passed a year at Venice. He was befriended by Maximilian I., Charles V., and Ferdinand of Bohemia. In 1520 he was in the Low Countries, especially at Antwerp, and much of his best work seems to have been owing to the example of Flemish art. It is doubtful whether his painting would have brought him lasting reputation, but in engraving he is a great master. Of his known works there are 105 engravings on copper and 170 on wood, while some of his larger works were composed of many smaller plates. His faults are stiffness and indifference to perspective, but these are far outweighed by his excellencies. Among his

paintings may be mentioned the *Fête of the Rosière*, which is at Venice, and *Christ Disputing with the Doctors*, and some portraits of his father, which are at Sion House. He sculptured in wood and ivory, and made architectural designs, and wrote a treatise upon fortifications and books upon art.

D'Urfey, THOMAS (1628-1723), poet and dramatist, was born at Exeter from a family of French refugees. He prepared for the bar, but turned aside to literature and wrote sonnets, ballads, odes, and about thirty pieces for the stage which were popular and were tainted by the licentiousness of the age. He was a friend of Addison and Steele, and satirised Charles II., Anne, and William III. In 1683 he published a *New Collection of Songs and Poems*, and in 1719-20 *Wit and Mirth, or Pills to Purge Melancholy*.

Durham, a northern coast-county of England lying between the Tyne and the Tees, having a length of 55 miles, a breadth of 35 miles, and an area of 973 square miles. The western part is occupied by the Northern Pennine range, rising to a height of 2,196 feet; and eastward of this are bleak heights, throwing out spurs among which are fertile valleys through which streams flow. Of the rivers the principal are the Tyne, the Wear, and the Tees, which are navigable for a few miles. The geological formation is of mountain limestone, millstone grit, magnesian limestone, new red sandstone, with veins of basalt or greenstone; and the county contains part of the Newcastle coalfield, and is, in fact, one of the most important coal-producing districts, a strike of the Durham miners sufficing to paralyse half the industries of the North. Those who know the Greta at its junction with the Tees will remember how the river has hollowed out for itself a channel in the limestone, in which the bather will not find a particle of mud. The moors of the west afford good pasturage for sheep. In the east of the county there is clay, upon which cereals are grown, and stock is raised. The alluvial bank of the Tees makes a good grazing-ground, and the short-horned breed of Teeswater cattle is famed throughout the world. The valley of the Derwent is well-timbered. The mineral productions of the county are coal, lead, limestone, black marble, zinc, ironstone, firestone, slate, millstone, and freestone; and among the industries are mining, iron-smelting, shipbuilding, iron, coke, glass, and pottery making, and the manufacture of chemicals. The capital of the county is Durham (q.v.), and the other large towns are Stockton, South Shields, Sunderland, and Hartlepool. Durham is a county palatine, till lately in the jurisdiction of the Bishop, but now an appanage of the Crown. There are eight parliamentary divisions, returning each one member, and seven parliamentary boroughs. The Roman occupation is marked by several towns ending in "chester," and by the existence of altars, coins, and urns. In Saxon times the county formed part of the kingdom of Northumberland, and at a later period suffered much from the incursions of the Scots. Pop. (1901), 1,187,824.

Durham (formerly *Dunholme*), a city and parliamentary borough on the river Wear, capital of the county of the same name. The town is built upon several heights, and has, besides its noted cathedral and castle, a town hall, a new hall, prison, grammar school, university, training college for mistresses, free schools, and several churches. The chief industries are the making of carpets and of mustard. The cathedral is on a kind of peninsula running east and west, and almost surrounded by the Wear, which flows in a picturesque ravine beneath. St. Cuthbert's shrine was established here in 995, and the present building was constructed by Bishop William in 1093, and its

of which colony he wrote a good report. Owing to complaints as to his administration, he left Canada of his own accord, and returned to England.

Durian, the fruit of *Durio zibethinus*, a large tree belonging to the *Sterculiaceae*, commonly cultivated in the Malay archipelago. It is spherical, 6 to 8 inches in diameter, with a thick hard rind covered with strong sharp prickles. It is five-chambered, each chamber containing from one to four seeds as large as chestnuts, which are roasted and eaten. They are embedded in cream-coloured pulp with an odour of rotten onions or putrid meat, but with a delicious flavour, compared to a rich



DURHAM CATHEDRAL. (From a Photograph by Messrs. Frith & Co., Heligade.)

appearance justifies the description, "half church of God, half castle 'gainst the Scot." It is associated with both St. Cuthbert and the venerable Bede. The castle—now the University—was founded in 1072 by William I. A college was founded in 1290 by the Prior and convent; but this fell into abeyance, until the Dean and Chapter applied for a charter, which was granted in 1837, for the University already founded in 1832. In 1846 Hatfield Hall became incorporated with the University. Most of the arrangements follow those of the older universities. Durham returns one member to Parliament. Pop. (1901), 14,641.

Durham, JOHN, EARL OF (1792–1840), an English statesman, was born of an old county family. In 1813 he became member for Durham, and showed himself an ardent reformer. In 1828 he was created Baron, and in 1830 was appointed Lord Privy Seal in Lord Grey's ministry, and was employed to support the Reform Bill in the House of Lords. He afterwards was ambassador to Russia, and in 1838 was made Governor-General of Canada,

custard flavoured with almonds with suggestions of cream-cheese, onion sauce, and brown sherry. It is eaten when not quite ripe, raw, cooked or pickled, and is pronounced even by some Europeans to be perfect.

Durra, the Arabian name for the Indian millet, *Sorghum vulgare*, which is generally known in India as *Jowar*, and in the West Indies as *Negro* or *Guinea corn*. Of unknown origin, this strong-growing grass, which reaches 4, 5, or even 16 feet in height, and produces a crop of its round brownish-red grain upwards of a hundredfold that sown, is largely cultivated in China, India, Egypt, Equatorial Africa, Southern Europe, and the United States. Its sweet culm and its leaves, which are 2 inches broad and 2½ feet long, afford excellent fodder; but it is still more valued as a cereal. In England it is used as poultry-food.

Duray, VICTOR, a French historian born at Paris in 1811. At 19 he entered the *École Normale*, and in 1833 was appointed Professor of History at

Rheims, and a few months later at the Collège Henri IV. at Paris. He was (1863-69) Minister of Public Instruction, in 1867 he was made a member of the Legion of Honour, and entered the Academy in 1885. Among his works are historical geographies of Rome, the Middle Ages, and France; an *Atlas de Géographie Universelle*; and some histories, especially that of Rome down to the time of Theodosius.

Dussek, LADISLAUS (1761-1812), pianist and composer. After being organist at Kuttenberg, he went to Prague, and from there to Belgium, where he acted as organist at Malines, and then at Bergen and at Amsterdam, where he first became associated with the piano. In 1783, being then 22 years old, he visited Emmanuel Bach, and then came to England with a musical scheme, which failed. In 1808 he came to Paris, and was patronised by Talleyrand, who made him director of concerts. Prosperity was too much for him. Among his works are 76 pieces for the piano, a "*Méthode*," some unsuccessful operas, a *Messe Solennelle*, and some German oratorios.

Dusseldorf, a town in a district of the same name, in Rhenish Prussia, on the right bank of the Rhine at the influx of the Dussel, crossed by a bridge of boats, 24 miles N.W. of Cologne. It consists of the Altstadt, Carlstadt, and Neustadt, and was formerly surrounded by ramparts, which were converted into boulevards in 1802. It has good streets and squares, with gardens, flowers, and shrubs, and is adorned with statues and fountains. In the market place is a statue of the Elector John William, who in 1690 founded a picture gallery, most of whose former contents are now at Munich. Among the principal buildings are the Art Hall, the Gallery of Modern Paintings, the old electoral palace, the Governor's residence, the observatory, the town hall, the theatre, and the library. Of the 25 churches, that of St. Lambert (14th century) and that of St. Andrew (the Hofkirche) are the most notable. There is a fine hofgarten. Dusseldorf is an important railway junction, and there are manufactures of iron and cotton. It was united to Prussia in 1815. Heine was born there.

Dutch Liquid, ethylene chloride ($C_2H_2Cl_2$), is an oily liquid formed by the action of chlorine upon ethylene (C_2H_4). Owing to the formation of this liquid, the latter compound is also known as olefant gas. It boils at 85° , and has a chloroform-like smell. It acts as an anæsthetic, but is not much used for this purpose.

Dutch Metal is an alloy of copper and zinc, containing about three parts of the former to one of the latter. It has a yellow colour, and is very malleable, so that it may be obtained in thin leaves resembling, and often used instead of, gold leaf. It may be readily distinguished from the latter by its solubility in acids, and by the greater ease with which it tarnishes.

Dutens, LOUIS (1730-1812), an author who came to England, and was appointed chaplain and secretary to Stuart-Mackenzie, ambassador at

the Court of Turin, and remained there as *chargé d'affaires*. He received a pension on his return, and was appointed Historiographer Royal, and was presented to the living of Elsdon by the Duke of Northumberland. He published an edition of Leibnitz's works, an English history, poems, and works upon theology, numismatics, and travels.

Duval, CLAUDE (1643-1670), a famous highwayman, was born in Normandy, and came to England with the Duke of Richmond. His adventures, fabulous or other, are well known, as are the tales of his politeness in the exercise of his calling. He was hanged, and buried in Covent Garden church.

Duyker Bok (*Cephalophus*, often incorrectly written *Cephalophus mergens*), a small South African antelope, owing its popular name to the fact that it plunges through, rather than springs over, bushes and brushwood.

Dvorák, ANTONIN (born 1841), a Bohemian composer of Mulhausen. In his childhood he went to Paris, and after a long and bitter struggle he composed a hymn and chorus for the organ, which brought him into notice. His *Stabat Mater* was performed in England in 1883. He composed or collected many gipsy songs, and a strong national character pervaded his works. He died in 1904.

Dwair. 1. A large Berber tribe, settled on the shores of the great Salt Lake, province of Oran, Algeria. They have always been friendly allies of the French, and their chief was the famous Mustupha ben-Ismael, who fell in his eightieth year while serving under the French against Abdel-Kader. 2. A Berber tribe in the uplands north-east of Boghar, province of Algiers.

Dwaish, a numerous people of the Upper Senegal Valley, North-west Africa, originally Berbers, but much mixed with Arab and Negro elements, and now speaking Arabic. They are continuous on the east with the Brakna Moors, and claim as their territory all the land along the banks of the Senegal towards the north-west of Bakel. (General Faidherbe, *Annuaire du Senegal*, 1858.)

Dwalla, a Bantu people of the Cameroons district, West Africa, settled chiefly about the Lower Wuri and Cameroon estuary. They are the best known of all the natives of this region, having long dwelt in the vicinity of the European factories and missionary stations. The Dwallas are typical Bantus, with regular, almost European, features and well-developed lower extremities, in this respect presenting a marked contrast to the pure Negro races. Like the neighbouring Bakwiri they are well skilled in the "drum language," which is widely diffused amongst the coast peoples of the western seaboard. By this process of toin-toming and horn-blowing sentences are distinctly expressed, and news of all kinds rapidly communicated from tribe to tribe. The system is jealously guarded against women, slaves, and Europeans, not one of whom has ever succeeded in obtaining a clue to its interpretation.

Dwarf, a human being considerably below the normal height. Supernatural dwarfs play a great part in mythology and folk-lore. [ELVES, GNOMES, PIGMIES, FAIRIES.] Thus in Norse and German legends they are cunning miners and metal-workers, living among the rocks, and often entering into various relations with mortals. It is very probable that such stories may embody reminiscences of some prehistoric race of small stature, whom the entrance of later races into Europe drove to the woods and mountains (*cf.* the wood Veddahs of Ceylon). Reports of dwarf-races are common [PIGMIES], and the existence of the Bushmen and Akkas (the dwarfs who hampered Stanley so seriously in his latest expedition) indicates that they have a basis on fact. Dwarfs as cases of arrested growth are not unfrequent among races of normal height. There are records of a very doubtful character of adults below 2 feet in height; but there are many certainly ascertained cases below 3 ft. 4 in. The dwarf Richebourg (*see* below) was only 24 in. in height. About 90 years ago two women, "the Corsican Fairy" and "the Irish Fairy," were exhibited in London; the latter, 34 in., died in childbirth. A Dutch dwarf, 28 in. in height, was exhibited in London about 1815. At birth, of course, many dwarfs have been much smaller—*e.g.* the Pole Borulawski was 8 in. long at birth, and was taken to his christening on a plate. In court and social life dwarfs have sometimes been conspicuous figures—*e.g.* in the households of the Roman Emperors Augustine, Tiberius, and Domitian, and of many distinguished Romans under the Empire, as also in various European courts during the 16th and to the end of the 18th century. Thus Jeffery Hudson, originally one of the Duke of Buckingham's suite, became court dwarf to Charles I. Important foreign missions were sometimes entrusted to him, but he is best known from the fact that he killed a courtier in a duel. He is said to have been only 18 in. high at 30, but he grew afterwards. Richebourg, who had been in the service of the Orleans family, died in 1858 at the age of 90. Dressed as a baby he had once served as the vehicle of important despatches. The Polish dwarf, Count Joseph Borulawski, who led a life of considerable variety in the suite of Polish noblemen, was well known in Paris about 1775. Probably General Tom Thumb (Charles S. Stratton) is the best-known of modern dwarfs. Born at Bridgeport, U.S., in 1832, he was exhibited by P. T. Barnum in 1842, and visited Europe in 1844. He married another dwarf (Lavinia Warren, of Middlesex, Mass.) in 1863 under the auspices of his showman, in New York. The wedding and the presents were fit for a princess. The pair, with the bride's sister, Minnie Warren, Commodore Nutt, and their baby, visited Europe in 1865. "The General" made a large fortune, but having (it was said) been unfortunate, revisited England some years ago. All these were perfectly formed. The baby died at two years old. A "miniature wedding" of the same kind took place at Charles I.'s court (the pair had several children, those who grew up reaching a normal stature), and another at the court of Catherine of Russia. While

giants are usually good-tempered, slow, and somewhat feeble-minded, dwarfs are said to be ordinarily quick, irritable, and spiteful.

Dwight, TIMOTHY (1752-1817), an American Presbyterian writer born in Massachusetts. He was a Professor at Yale College at the age of 20, and became an army chaplain in 1777. In 1798 he became President of Yale College. His chief works are *The Conquest of Canaan* (a poem), *Theology Explained and Defended*, and *Travels in New England and the State of New York*, which are interesting as illustrating the period.

Dwina, or DUNA, the name of two Russian rivers. 1. The Western Dwina rises in a marshy forest in the district of Ostrakhof, 15 miles W. of the source of the Volga, and flows circuitously S.W. to the town of Vitebsk, when it flows N.W. and separates Vitebsk and Livonia from Minsk and Courland, and after a course of 500 miles falls into the Gulf of Riga 10 miles below the town. It is navigable for some distance during spring, but the stream is impeded by rapids. It receives several tributaries, and is liable to inundation. Fish are plentiful. 2. The Northern Dwina is formed in the government of Vologda by the union of two smaller streams, and flows N., and after a course of 400 miles falls into the White Sea, 30 miles below Archangel, by several mouths, forming an island delta. By a system of canals it is the means of uniting the White, Black, Baltic, and Caspian Seas.

Dyce, ALEXANDER (1798-1869), critic and commentator, was born at Edinburgh, and educated at Edinburgh High School and at Exeter College, Oxford, where he graduated in 1819. He entered Orders, but abandoned them for literature. He began with *Extracts from Quintus Smyrnaeus*, and *Specimens of English Poets*. He brought out an edition of Shakspeare and other poets, and in 1831-35 an edition of Shakspeare's poems. Besides several essays, he wrote *Recollections of the Table-Talk of Samuel Rogers*.

Dyce, WILLIAM, R.A. (1806-1864), a painter, born at Aberdeen and educated at Marischal College in that city. In 1825 he went to Rome and showed a tendency towards pre-Raphaelitism. He exhibited at Edinburgh in 1830 and in 1844 was appointed Professor of Fine Arts at King's College, London. He was chosen to aid in the decoration of the Houses of Parliament and of Osborne House. He became A.R.A. in 1844, R.A. in 1848. He was also an author, having brought out an edition of the Prayer-Book and a work on *Plain Chant*.

Dyeing. The art of dyeing consists of the fixing in fabrics of colours in such a manner that the colour is of a fairly permanent character. As many passages in older writings show, the art was practised by the ancients; thus the Tyrian purple is alluded to by Pliny, and was probably known 1000 B.C. The Phenicians and Egyptians were well acquainted with various processes for dyeing materials, and manufactured some of their colouring preparations on the large scale. In Europe the

knowledge appears for some time to have been restricted to the Jews. In the 15th century, however, dyeing in various shades and colours was well known in Europe, and the first text-book upon the subject appeared in 1540, while other books of this period are extant, containing recipes for the preparation of many dyes. The artificial preparation of innumerable dyes from coal tar, which followed Perkin's preparation in 1856 of the first dye from that source, has had the greatest possible influence upon dyeing and marks the 19th century as a most important epoch in the history of the industry.

Before dyeing a fabric it is essential that it should be perfectly white and scrupulously clean, as not only would any colour upon the material serve to materially detract from the brilliancy and alter the shade of the dye, but it is also found that a small quantity of impurity has often a great and generally deleterious effect upon the colour. The first process, therefore, in dyeing, is the bleaching of the fabric, which should be of a thorough character, followed by washing in several changes of water. [BLEACHING.] From the above also it is seen that it is necessary that the water employed throughout should be of a high degree of purity, for although in certain cases the presence of particular salts may be unprejudicial, or even desirable, it is always better to add them, as required, to the pure water.

The method employed varies according to which of two classes of dyes is used. Those of the first class have the power of directly fixing themselves upon the cloth, without the assistance of any other substance. In this case the dye is dissolved or finely suspended in water, and the material placed in the solution, and kept in constant motion in order to ensure uniformity in the dyeing. When the desired shade of colour is obtained the material is taken out, well washed in a large supply of water, and dried. This mode of dyeing is of more frequent application with wool and silk than in the case of cotton, etc. In the other and larger class of dyes, however, simple immersion does not suffice, and it is necessary to fix in the cloth some substance—the *mordant*—which causes the adherence of the dye to the fabric. In many cases, also, the dyestuff itself is colourless or nearly so, and union with the mordant is necessary for the development of the colour, which may vary according to the particular mordant employed. In such cases the cloth is generally impregnated with the mordanting substance before the application of the dyestuff. This is generally done by boiling with, or passing through, a hot solution of the mordant, and pressing off the excess by rollers. It is then treated with the dye in the ordinary manner. In some cases, however, the fabric is treated with the dye first, and in other cases both mordant and colouring material act simultaneously upon the cloth. With regard to the theory of the nature of the process, it seems probable that in some cases there is merely a physical attraction between the colouring matter and the fibres of the fabric, while in others true chemical combination occurs. When mordants are employed their function seems to be

to combine readily with both the fibre and the colouring matter, so that the colour produced by its union with the latter is fixed in the fabric. It thus appears evident that the nature of the mordant must vary with that of the dyestuff; in the case of dyes of an acid nature, basic mordants are required, and with basic dyes, acid mordants must be used. The principal mordants for general usage are the following:—(1) Metallic salts, which are used as basic mordants, e.g. alum, chromium salts, nitrate or sulphate of iron (copperas), and tin salts, more especially the chloride SnCl_2 , known in the trade as tin crystals. (2) Acid mordants, employed for fixing basic dyes, e.g. tannic acid and various fatty acids generally prepared by the addition of sulphuric acid to a fat or oil.

The dyestuffs employed are exceedingly numerous. They may be divided into (1) those obtained directly from natural products, as from decoctions of barks of trees, animal products, etc.; (2) inorganic pigments, or coloured salts, such as lead chromate, which are frequently formed from their constituents during the process itself; (3) artificial organic dyes, now the most important class. The greater number of these latter are obtained from coal-tar, and known as coal-tar colours. Many of them are of the chemical nature of amines (q.v.), and require basic mordants; others are related to phenol, and require basic mordants; some are obtained from naphthalene or anthracene (q.v.); and a large number are related to a compound known as azobenzene ($\text{C}_6\text{H}_5\text{N} \cdot \text{N} \cdot \text{C}_6\text{H}_5$). These latter have within recent years acquired considerable importance, as very many have the power, possessed by few other dyes, of dyeing cotton without a mordant. Some of the commoner dyes required for particular colours are the following:—

Red. Chief are *cochineal* for wools, and *madder* or the artificial *alizarin* for cotton. In the first case, the wool is mordanted by boiling with tin-salts, and, after washing, brought into a boiler containing the cochineal in suspension, and there boiled until the colour of the liquid is discharged. This gives a scarlet, but other mordants give other colours; thus by the use of alum a crimson is obtained. For cotton the madder is now largely replaced by alizarin, as better tints may be obtained by the use of the artificial colour. The mordants employed are generally tin-salts or alum. The cotton is treated before the operation with an oily emulsion, and after dyeing the colour may be brightened by boiling with soap or alkalis.

Blue. *Indigo* is the chief dye employed. This dye is insoluble, and cannot therefore be used by itself. If reduced, however, a substance known as *indigo white* is obtained, and this, dissolved in an alkali, is generally employed. The cloth is agitated in this solution, and after a sufficient time withdrawn. Though not coloured when taken from the liquid, the colour makes its appearance when the fabric is exposed to the air. A sulphate of indigo is also much employed for wools and silks. *Prussian blue* is also employed for blues. The material is first soaked in nitrate of iron, and then washed. Some oxide of iron is thus formed in the material, and this, when the fabric is treated with yellow

prussiate of potash (potassium ferrocyanide) and an acid, yields Prussian blue, which is hence formed in the fibres of the cloth. Many aniline blues, as *spirit blue*, *methyl violet*, *water blue*, are also largely employed with wool or silk, and give beautifully brilliant colours. They have all a complicated composition, but are mostly derivatives of *triphenyl methane*, $C(C_6H_5)_3H$.

Yellow. The chief natural yellow dyes are *fustic yellow*, a dyestuff obtained from the bark of a Central-American tree, and *Quercitron bark*. A number of artificial yellows are known. Amongst these may be mentioned—*lead chromate*, which is formed in the fabric by treating with (1) lead acetate, (2) potassium chromate; *picric acid*; *naphthol yellow*, derived from naphthalene; *rosolic acid* and *aurine*, related to the triphenyl methane mentioned above; and a number of dyes derived from azobenzene.

Greens, purples, etc., can be often obtained by a judicious mixture of two dyes. Fine greens and purples are also given by different coal-tar colours, while madder used with an iron mordant also gives a purple.

For *black* dyes, logwood is generally used for wool and cotton, gull-nuts for silk, while aniline black may be also employed. Wool is heated in decoction of logwood, and then with sulphate of iron, and may or may not be first dyed with indigo. In silk-dyeing a decoction of gall-nuts takes the place of that of logwood. [CALICO-PRINTING.]

Dyer, GEORGE (1755–1841), scholar and antiquary, was born in London, and educated at Christ's Hospital and at Emanuel College, Cambridge, where he graduated in 1778. He occupied himself for a time as a tutor, and settled in London in 1792. In 1814 he published a *History of the University and Colleges of Cambridge*, and in 1824 a work on *The Privileges of the University of Cambridge*. He also did much of the work for Valpy's Classics, and wrote in magazines. He was a friend of Charles Lamb, who makes mention of him.

Dyer, JOHN (1700–1758), poet, was born in Caermarthenshire, and educated at Westminster. He at first adopted his father's profession—that of the law—but abandoned it, and wandered in Scotland, Wales, and England, enjoying the country scenery. In 1727 he wrote *Grongar Hill*, a poem marked by simplicity and an appreciation of scenery. He then went to Italy, and published in 1740 *Ruins of Rome*. In 1757 he published *The Fleecce*. He died a Lincolnshire vicar.

Dyer, THOMAS HENRY (1804–1888), archaeologist and historian, was born in London. He went to the West Indies, and was for a time employed in trade, which he afterwards abandoned for literature. He travelled much, giving special attention to topography. He wrote histories of *Modern Europe*, *The City of Rome*, *The Kings of Rome*, and *Pompeii*. He also wrote upon ancient Athens, and provided many articles for Dr. Smith's dictionaries.

Dyke. 1. In *Geology*, a vertical or highly inclined sheet or vein of intrusive igneous rock, from an inch

or two to 60 or 70 feet thick, extending for a few yards or for many miles, the thicker ones being generally more persistent. They may consist of granite, pegmatite, or urtite, but are more typically basaltic, basalt, dolerite, diabase, and diorite commonly occurring in this form. They often exhibit prismatic jointing, the prisms being horizontal, at right angles, that is, to the surfaces of cooling of the dyke, and their outer surface is often glossy from a layer of tachylite (basaltic glass). Though they serve as girders binding together the loose tufts of volcanic cones through which they are thrust, as in the Val del Bove, Etna, in Vesuvius, in Santorin, and at Funchal, they often traverse non-volcanic rocks for miles in straight lines, sometimes in parallel lines. Their material being often harder than the rock they traverse, denudation has left them standing out like walls (*Sentinel dykes*), as is the case with the diabasic Great Whin Sill of the North of England, along part of which the Roman wall was carried. In other cases the dyke has been disintegrated first, leaving deep ditch-like ravines. Dykes frequently graduate into veins or sheets. They alter the rock they traverse, indurating clay into porcellanite and converting chalk into crystalline marble, as in Rathlin Island, or coal into soot, or at a greater distance into graphite, as at Cumnock in Ayrshire.

2. In *Engineering*, means an embankment of earthwork generally erected to ward off water from a tract of land. Dykes are necessary in low-lying countries like Holland, where inroads are frequently attempted by the sea. They must be well and strongly built, and repairs must be effected as soon as any damage is done. The bursting of dykes has caused immense loss of life and property in Holland, Hungary, China, and elsewhere.

Dykes, JOHN BACCHUS (1823–1876), composer, was educated at Cambridge, and took Orders in 1847. In 1849 he was appointed Precentor of Durham cathedral, and in 1861 became Mus. Bnc. of Durham University, and in 1862 Vicar of St. Oswald's. He contributed much to *Hymns Ancient and Modern*, and wrote the music of *Lead, kindly Light*; *Nearer, my God, to Thee*, and *Jesu, Lover of my soul*.

Dynamics is the study of forces. From Newton's definition of force we are able to see the natural divisions of the subject. This definition is as follows:—Force is that which changes or tends to change a body's state of rest or motion. It will be seen that there are four parts to the definition. Two of these lead to *Kinetics*, and the other two to *Statics*. The study of forces whose resultant action changes a body's state of rest or motion, is termed *Kinetics*; the study of forces which in combination only tend to change a body's state of rest or motion, is termed *Statics*. Many writers use the term *Mechanics* to include the whole subject, and divide it into the branches *Dynamics* and *Statics*, assigning to *Dynamics* the meaning that has been given above to *Kinetics*. Strictly speaking, the study of machines should be called *Mechanics*, which is, therefore, a special branch of Applied *Dynamics*.

In the case of forces acting on *water* or other

liquids, we speak of the science of Hydrodynamics, with its divisions Hydrokinetics and Hydrostatics. Applied hydrodynamics is usually termed *Hydraulics*.

In the case of forces acting on *air* or other gases, the term Aerodynamics may be used, with its branches Aerokinetics and Aerostatics. Applied aerodynamics is usually termed *Pneumatics*.

Finally, the investigation of the motions of bodies without regard to the forces that may be involved in the production of the motions, is in the province of *Kinematics*.

The force-relations with small bodies, whose magnitudes are negligible when compared with their masses, are usually discussed under the head of Dynamics of a Particle. Those bodies that are not strained by the forces acting on them, *i.e.* whose particles do not suffer any change in relative position to each other, are called *rigid* bodies, and their behaviour under the action of such forces gives us Rigid Dynamics or the Dynamics of Rigid Bodies. Whereas all solids become rigid under the action of sufficiently small forces, none are capable of remaining so if the stresses applied to them exceed definite limits. Principles obtained from a discussion of these two branches are employed in the extension to the dynamics of strained or discontinuous bodies, concerning which, however, comparatively little is known.

Starting with a consideration of motion itself, apart from any question of what may produce it, we first assign a definition. Motion is change of position. Change of position can only be recognised by comparison with the position of other bodies; this fact is expressed by the statement that we have only cognisance of *relative* motion. Thus, so far as appearances are concerned, there is no telling whether the earth is rotating round its axis from west to east, or whether the sun, moon, and stars are rotating round the earth from east to west.

If a rigid body move so that each particle in it travels along a straight line parallel to the path of every other particle, it will invariably present the same aspect in any given direction, and is said to have a *motion of translation*. Such a motion is instanced by the body of a railway-carriage that runs along a straight railroad. If the rigid body moves so that one set of points in a line is constrained to remain fixed, it is said to have a *motion of rotation* about that line as axis, as in the case of a flywheel on a piece of shafting. If it moves in any other way, its motion will at any instant be compounded of translation and rotation, as in the case of a wheel of the above carriage. It rotates about the axle, and the axle is translated bodily onwards.

Now the rate of change of position may be expressed numerically. It is called *speed*, and we find the average speed of a moving particle during any interval of time by dividing the distance it traverses by the time taken. The simplest sort of motion is uniform motion in a straight line; in this case we should obtain the same average speed whatever interval of space or time we happened to select for measurement. If a train travel 200 miles in 5 hours, its average speed is 40 miles per

hour. If for this period of 5 hours its speed be uniform, we should obtain the same result—40 miles per hour—for any second or minute or hour during the whole five hours.

A body may move in a curved path with constant speed. Its *velocity* is in that case not constant, this conception involving the magnitude, direction, and sense of the motion [VELOCITY], and whereas the speed is constant because it only involves the magnitude of motion, the velocity varies because the direction of motion varies along the curve. Change of velocity is called *acceleration*, and is measured by the amount of change of velocity divided by the time taken to effect the change. When this rate of change is uniform, we have a constant acceleration, as in the case of a falling body near the earth's surface.

It is now necessary to come to the causes of change of motion. The whole science of dynamics is based on three laws formulated by Newton. They were not proved by him, nor by anyone else, being results obtained from experience. We find them true experimentally, and assumptions based on them do not lead to false conclusions. They may be thus stated:—

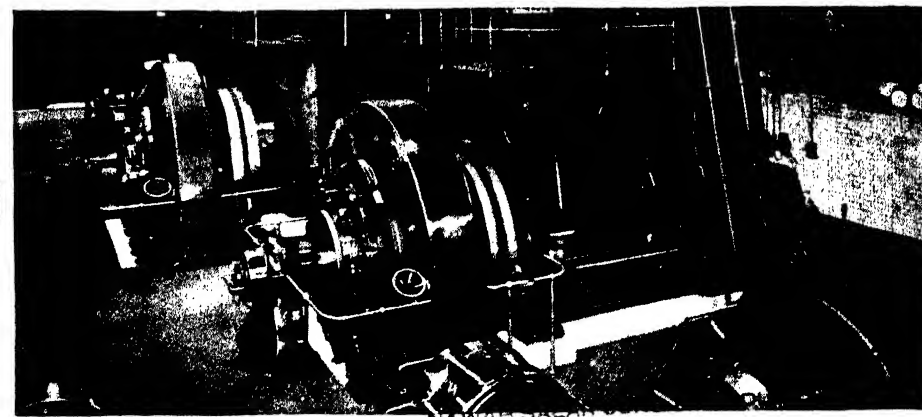
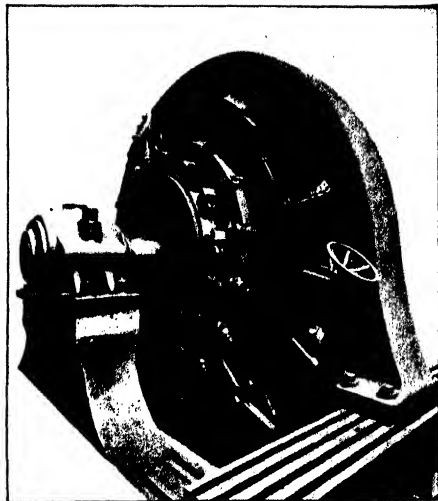
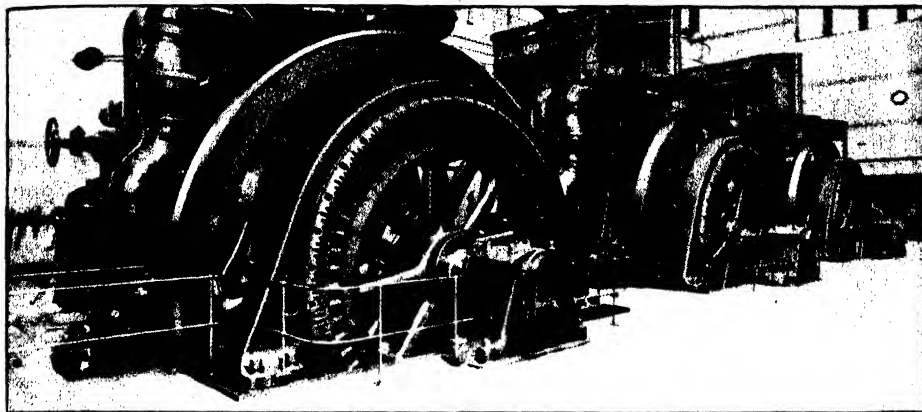
1. Every body continues in its state of rest or of uniform motion in a straight line, except in so far as it may be compelled by impressed forces to change that state.

2. Change of motion is proportional to the impressed force, and takes place in the direction of the straight line in which the force acts.

3. To every action there is always an equal and opposite reaction; or the mutual actions of any two bodies are always equal and oppositely directed.

From the first law it is seen that if a body be motionless, or if it possess uniform motion in a straight line, such a state of things is permanent till fresh impressed force acts on it. Hence every impressed force produces an acceleration in the body; accelerations produced by different forces may or may not neutralise one another, but each being a measure of the effect produced is a measure also of the cause. The second is the law of quantity. It states that force may be measured by the amount of motion it gives to a body in a definite time. A standard force will give standard velocity to standard mass in standard time; or, using the centimetre-gramme-second system of units, we say that a force of one dyne will in one second impart a speed of one centimetre per second to a mass of one gramme. The amount of motion in a body is termed its *momentum*, and is measured by the product of its mass and its velocity. Change of momentum implies the action of force, and the time-rate of change is a measure of the force.

The third law admits of enormous extension, and may be interpreted as an enunciation of the principle of Conservation of Energy (q.v.). Primarily, it states that when two bodies act on one another the force that one exerts on the other is exactly equal to the force that the second exerts on the first. Hence the momentum given to one is equal to the momentum received by the other, and there is therefore no change in the momentum by their interaction, though there may be a redistribution of the same.



DYNAMOS.

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|---|---|
| <p>1 STALYBRIDGE, HYDE, MOSELY & DUKINFELD POWER HOUSE. (Photo supplied by Dick Kerr & Co., Ltd.)</p> <p>2 100 KW. CONTINUOUS CURRENT GENERATOR, 6 POLES,
450 R.P.M., 250 VOLTS
(Photo supplied by Dick Kerr & Co., Ltd.)</p> | <p>3. STANDARD DICK KERR GENERATOR.
(Photo supplied by Dick Kerr & Co., Ltd.)</p> |
|---|---|

The dynamical notion of *work* is the production of motion against resistance, effected by the action of a force through a definite distance. To do work *energy* must be available, energy being measured by the amount of work it can do. If, therefore, a body possesses energy, and effects motion against resistance, the third law tells us that the resistance is of the same magnitude as the force exerted by the body, and that the energy spent by the acting body is taken in by the resisting body. There is, then, no loss of energy during the interaction, though it may change its form.

Energy may be given to a body by the action of a force thereon. We know that force may be required to change the position of a body; if this change is effected without dissipation of energy in friction, the body will either possess a finite velocity, or else occupy a position from which it will pass with accelerated motion if only it be not subjected to constraint. In the former case the energy it receives is *kinetic*, and in the latter case *potential*. [ENERGY.] Anything from which energy may be obtained is called a source of energy, though, strictly speaking, it is never more than a converter of one form of energy into another. The rate at which the supply may be obtained is called the *power* of that source. Any converter can supply an indefinitely large amount of energy if only sufficient time be given to it; but the more powerful the machine is, the less the time taken to render a given amount of energy available.

Dynamite. [NITRO-GLYCERINE.]

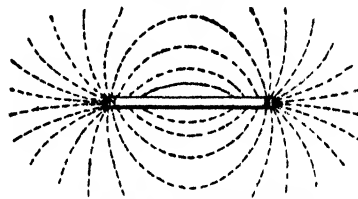
Dynamo. [DYNAMO-ELECTRIC MACHINERY.]

Dynamo-Electric Machinery is understood to class together all such machines as will convert energy of mechanical motion into that of electricity in motion, or the reverse. The former conversion is done by *dynamos*, to which power is given by steam-engines or other such prime-movers, and made to generate in conducting circuits alternate or direct currents of electricity. *Motors*, on the other hand, receive the energy of electrical currents, either alternate or direct, and this produces motion of certain parts of the structure. The theory of the action of a dynamo was first discovered by Faraday in 1831; it is intimately associated with that of a motor, for the principle of conservation of energy points out that either machine is reversible—that is to say, a dynamo may be used as a motor or a motor as a dynamo, though perhaps not so efficiently as when each fulfils the special function for which it was designed.

Lines of Force. In the neighbourhood of any magnet we know that magnetic force manifests itself. A small needle free to assume any position will adjust itself in a definite direction at any spot, evidently under the action of opposite forces at its extremities. If it were possible to isolate the north-seeking pole of the small needle, we should find it repelled from the north pole of the magnet and, if hindrance be removed, carried along a definite line till it reached the south pole of the magnet. Such a line is called a *line of force* in the magnetic field, the latter term representing all space where the

magnetic influence is felt. The whole field is regarded as being mapped out with such lines of force, the closeness of their distribution in any region being proportional to the intensity of the force there. Faraday showed that such a distribution would be perfectly continuous; no line would terminate abruptly in space or merge into another line, but would travel from one pole of the magnet to the other, passing thence through the magnet back to its starting point.

Current Induction. If any substance be moved in any magnetic field so as to cut the lines of force, a disturbance of electricity is set up in the substance that is called a current. It is due to a difference of pressure or potential of electricity being induced in different parts of the moving mass by the passage of the lines of force through it, and unless infinite resistance be presented by the material an electric current must flow to equalise the potential. Energy



LINE OF FORCE OF BAR-MAGNET.

is required to produce this motion, and soon manifests itself as heat by the increase in temperature of the substance. When such currents run to heat in wasteful eddies they are termed Foucault currents; but the whole practical question of dynamos is to find the best means of utilising the available difference of potential for the production of an external current. This, for the most part, will sooner or later waste away in heat, but it may in the meanwhile perform useful work. Even allowing a rapid heat production, we may localise its intensity so as to produce useful light. All electric light represents a localisation of heat intensity into small mass, so as to get high temperatures and a consequent emission of light from the hot mass.

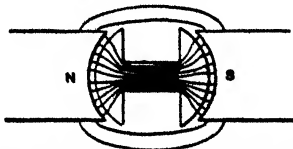
If then a wire be made to cut lines of force, a certain difference of potential is set up in the wire. This is proportional to the rate at which the lines are cut, and may be produced either by moving the wire through the field or by moving the lines of force through the wire. If the motion of the wire be reversed, the difference of potential produced will tend to send a reverse current. The accompanying sketch represents the simplest type of dynamo. The north and south poles of a magnet are arranged opposite each other, with a hollow cylindrical space between them. In this a wire bent into rectangular shape is placed so as to admit of rotation about its horizontal axis. The lines of force in the magnetic field are nearly parallel to each other, and pass across from left to right. Rotation of the wire must effect a cutting of these lines by the top and bottom portions of the rectangle, and a difference of potential, or

electromotive force, as it is called, will be induced in each portion; and because these are moving in opposite directions across the field, one moving down and the other up, the electromotive forces in each portion will be in opposite directions, and will therefore unite in sending a current through any conductor that joins the free ends of the wire.

This current will travel in one direction round the coil until half a revolution is completed. Then there is a reversal in the direction of the motion of each operating side of the rectangle, and a consequent reversal of the electromotive force (henceforth abbreviated E.M.F.) for the second half revolution. If this is gathered at the free ends without regard to the change in its direction, an alternating current will be produced in the circuit. But by means of an arrangement called a commutator (q.v.), which presents to one end of the external circuit always that terminal of the coil which is at the higher potential, and to the other end of the external circuit always the lower potential terminal, the direction of the current in circuit is rendered constant. The two great types of dynamo are now specified, *alternators* and *direct-current dynamos*. Both may be used for electric lighting, electric welding, for driving motors, and for the transmission of power by means of conductors; but only the latter for electro-plating, the charging of accumulators, or the magnetisation of iron.

From the above considerations we see that the induced E.M.F. in the moving coils may be increased (i) by making the field stronger in those regions where it is cut by the wire; (ii) by increasing the length of wire cutting the lines of force in such a way that a greater number are cut per second; (iii) by increasing the speed of rotation of the wire. The structure of wires or other conductors designed to cut the lines of force and induce an E.M.F. is called the *armature* (q.v.).

(i) With a field-magnet of given strength we cannot increase the total number of lines of force passing from pole to pole. But we may, to a great extent, direct them so as to strengthen the field locally, though other parts become weaker thereby. For wrought-iron possesses the property of conducting magnetic lines of force much more readily than any other substance, and will concentrate



Lines of Force through Soft-Iron Core.

them in itself to a far greater intensity than will the surrounding air. In the sketch a shuttle-shaped core of wrought-iron is shown between the poles of a magnet, with the deflected lines of force passing through the metal. If coils of wire are wound round this core, the E.M.F. developed on rotation of such an armature will be much greater than when the iron core is absent. But besides increasing the local intensity of the lines of force in the

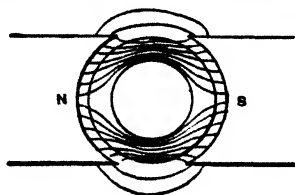
above manner, it is also possible to increase the strength of the field-magnet, and so add to the total number of lines passing from pole to pole. If a permanent magnet be employed, it should be built up of thin laminæ of steel strongly magnetised and bound together. But if the magnetism be induced by an electric current flowing in coils of wire round a bent core of iron, we get the strongest effects by using the softest iron available, by having as many coils of wire wound round the core as circumstances permit, and by employing the greatest magnetising current available to traverse the coils. [MAGNETISM.] Finally, the pole-pieces of the field magnets should be so shaped and placed that there is only just room for the armature to lie between them.

(ii) Methods of winding on armatures must be largely modified by practical considerations of strength, compactness, speed of rotation, and the arrangement of the field-magnets. The armature may revolve in a fixed magnetic field, as in the case of the Edison-Hopkinson or the Ferranti machines; the field-magnets may revolve about a fixed armature, as with the Mordey alternator, or both may be fixed and the lines of force put in motion by a revolving iron-piece or keeper. Most machines are of the first type. Again, the magnetic field may be produced by a single magnet or by one or more pairs. The Edison-Hopkinson has a single electro-magnet with its poles brought near together and shaped to receive a drum-shaped armature. The Manchester has two electro-magnets, which unite in forming a single field; and the Ferranti alternator shown in the plate has sixteen pairs of bar electro-magnets ranged cylindrically, with each pair in a line, and separated only by a small space $\frac{1}{2}$ in. wide that receives the thin circular armature. The thirty-two magnets are so placed that opposite poles face each other, and that the lines of force pass direct across the gap that separates them. For one pair they pass across from left to right; for the next pair from right to left, and so on alternately.

The construction of the Ferranti armature is shown in the plate. Copper ribbon is coiled several times round in eight pear-shaped loops, preferably wound on brass or other non-magnetic bobbins. The current is generally taken off from opposite sides of the armature, to prevent any excessive difference of potential between consecutive coils. The separate layers of ribbon are insulated with asbestos.

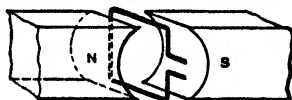
Direct-current armatures may be classed as drum or ring-armatures. The former type is developed from the H or shuttle armature of Siemens, which consisted essentially of an iron core with H-shaped section, round which wire was wound in the recess so as to form a cylinder that could revolve about its axis. (See sketch Armature.) The objection to this old arrangement was that the coils of wire were almost parallel to each other, and were all engaged in cutting lines of force at the same time; while some are cutting, the others should not be cutting, so that commutation shall produce a fairly constant current in the external circuit. The drum-armature has a cylindrical iron

core, upon which coils of wire are wound lengthways, their ends terminated at successive commutator segments at one side of the armature. The insulation of the separate coils is of great importance. Such an armature is possessed by the



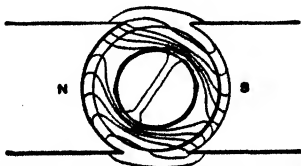
LINE OF FORCE THROUGH GRAMME-RING.

Edison-Hopkinson dynamo, and is shown in the plate. The ring-armature consists of a series of coils wound round a soft iron ring. The wire connecting each coil with the next is joined up with a metal segment on the axle of the armature. (See sketch Armature.) The set of segments, which are carefully insulated from each other, form a cylinder, upon opposite sides of which the brushes press which collect the current for the outside circuit. Each coil acts as a cell producing an E.M.F. in one



SIMPLE ARMATURE.

direction during half a revolution, and in the other direction during the second half. All the coils travelling round one side act as a battery sending a current upwards, and all the coils travelling round the other side send an equal current to meet the first. The brushes are placed so as to collect at the junctions of these two halves, and are made with sufficient bearing surface to keep two consecutive segments always connected. Owing to a twisting in the lines of force due to rotation of the



DISTORTED LINES OF FORCE THROUGH RING.

ring, the two coils that are producing no E.M.F. are not at the top and bottom of the armature, but at some angular distance from these positions. A definite *lead* or *advance* from the top or bottom is therefore necessary for the brushes. A ring-armature is illustrated in the figure of the Manchester dynamo. The core is built up of thin laminæ of soft iron, which prevent the formation of wasteful eddies in the metal.

(iii) The speed of rotation is limited by the strength of the rotating parts. Old armatures would fly to pieces if worked at modern rates of rotation. A speed of 600 revolutions per minute is common; the speed at the circumference of a Ferranti armature may exceed 6,000 feet per minute. For high speeds it is therefore necessary to ensure good mechanical design of the revolving parts. Uniformity of rotation is produced by having these parts very massive, or by the use of governors.

Classification of Dynamos. Dynamos that employ permanent magnets to produce the requisite fields are termed *magnetos*. Those that use separate currents from entirely different circuits to magnetise their field-magnets are known as *separately-excited* machines. In these two cases the strength of field is independent of the speed of rotation, or of any variation in resistance, etc., of the main circuit. But it is possible for the cores of wire round the field-magnets to form part of the main circuit. A little residual magnetism always exists in the cores, and suffices to start a current in circuit. This traversing the coils round the cores increases the strength of field, and consequently the strength of current produced, until the magnets become saturated, or the energy required to drive the armature at that rate too great to be supplied continuously. There are various branches of this type of machine, two of which are shown in the plate. The one is the *series* dynamo, where the whole current passes round the field-magnets. The other is the *shunt* dynamo, where a fractional portion of the whole supply is taken to the field-magnets, this fraction depending on the resistances of the field-magnet coils and of the external circuit. The advantages of these and other methods of magnetisation cannot here be discussed. Alternators cannot be self-exciting, for electro-magnets require direct currents. The Manchester dynamo in the sketch has both shunt and series coils, the Edison-Hopkinson only shunt coils.

Motors. As explained at the beginning of this article, a dynamo is a reversible engine. It can be worked as a motor. If a current be supplied at the brushes of a dynamo with rotating armature, that armature will be kept in motion. All electric motors are closely similar to dynamos in principle and in construction. They may be worked by direct or by alternating currents, and their efficiency is great. A problem occupying the minds of many at the present time is to obtain a good practical alternating motor that shall avoid the few difficulties now existing. One of these difficulties is that the motor must first be brought up to a definite speed before that speed can be maintained by an alternating current. There can be no doubt that the transmission of power may be most conveniently effected by electric currents, a dynamo at one end of the circuit converting kinetic energy into electrical energy, and a motor at the other end to effect the reverse conversion; and since alternate-current transmission is in many ways the better, alternating motors necessarily have a great future.

Dynamometer, in Engineering, is an instrument for measuring the power given out by an

engine of any kind. Such instruments are of two kinds, absorption dynamometers and transmission dynamometers. The former absorb all the power they are meant to measure, and must therefore be regarded as exceedingly wasteful, for the whole power of the engine is spent in the instrument, generally in overcoming frictional resistance. The latter absorb none and simply transmit the whole. They may therefore be employed when the engine is doing its ordinary work.

Dynastes is a genus of beetles including some of the largest known species. Some of them, such as the West Indian *D. hercules* (Linn.), are as much as six inches long.

Dyn, the centimetre-gramme-second unit of force—that is to say, it is a unit of force chosen so as to have simple relationship to the above-mentioned units of length, mass, and time. It is defined as the force that will in one second give a mass of one gramme a speed of one centimetre per second. It corresponds to the English *poundal*, which is based on the foot-pound-second-system.

Dysart, a seaport in Fifeshire, on the N. coast of the Firth of Forth, 13 miles N.E. of Edinburgh. In the fifteenth century there were salt works here, and some coal was worked in the sixteenth century. There is a flax factory here, and a harbour, and a space in the centre contains an old town hall. The old castle of Ravenscraig in the neighbourhood is utilised by Scott.

Dysentery, a disease characterised by inflammation of the mucous membrane of the large intestine. The mischief is said to involve, in the first instance, the solitary glands of the large intestine, which become swollen and hypertrophied, and if the attack be a severe one actual sloughs are formed, which are cast off, leaving patches of ulceration. These ulcers either heal with the formation of scar tissue, and consequent cicatricial contraction, or they remain open and irritable for a considerable length of time, giving rise to chronic symptoms of a peculiarly intractable character. The disease is, for the most part, limited to tropical countries. It is said to have prevailed largely in former days in England, but is now practically unknown, save in the case of those who have been to India or other warm climates. It is said by some authorities to be associated with aguish districts, but there is considerable difference of opinion in this matter. The main symptoms of the disease are fever, with diarrhoea and tenesmus. The discharges from the bowel contain mucus, and often blood. A fatal termination is not uncommon. In mild cases signs of amendment are manifested at the end of about a week. In the treatment of dysentery ipecacuanha has been found of service, and opium and astringents are of use in some instances. Abscess of the liver occasionally develops in persons who have been the subjects of attacks of dysentery.

Dyspepsia. [INDIGESTION.]

Dysphonia, difficulty in speaking, arising from disease in the larynx.

Dyspnoea, difficult breathing. [RESPIRATION.]

Dysporomorphæ, in Huxley's classification, a group of birds containing the cormorants.

Dysuria, difficulty in passing urine.

Dytiscidae, a family of water beetles, of which the small black water beetle, *Dytiscus*, is the typical and best-known genus. The larvae are, however, better known than the adult; they are popularly called "fresh-water shrimps."

Dzereu (*Procopra gutturosa*), an antelope from the arid plains of Central and Eastern Asia. It is about 30 inches high at the shoulder; greyish-fawn above in summer, becoming almost white in winter. The horns, present only in the males, are strong, black, and lyrate.

Dziggetai, one of the native names of *Equus hemionus*, the Tibetan Wild Ass. These animals, which live in small herds in the highlands of Central and Eastern India, stand about fourteen hands high, and are very swift and wary. There is a well-marked line on the back; but the shoulder-stripe, so conspicuous in the ass (*q.v.*), is wanting.

Dzo (LUSHAI), a numerous and warlike people on the north-east frontier of India between Hill Tipperah and Manipur west and east, and reaching southwards to the Chittagong district of Arakan; after long frontier troubles, finally reduced by the English in 1892. Dzo is the national name, though they are better known as Lushai, *i.e.* "Head-takers" (from *lu*, head, and *sha*, to cut) which is only the name of a particular clan. The Dzo are a branch of the wide-spread Kuki race [KŪKI], and are divided into a great number of clans, with three main divisions (Sukpilai, Lalbora, Laihi), all speaking closely-related dialects of the same Tibeto-Burmese language, and numbering collectively from 70,000 to 80,000 souls. (G. H. Dament; Captain Lewin, *Exercises*; Br. Nath Shaha, *Lushai Grammar*, 1884.)

E

E, the fifth letter of the Greek, Latin, and modern European alphabets. The symbol represents the Phœnician *he*, which somewhat resembles an E reversed, and is said to have been derived from a hieroglyph representing a window. [ALPHABET; compare D.] In Phœnician *he* was the rough-breathing, the modern H sound; but the Greeks took it to represent that sound for which it now stands in languages of the Continent of Europe. Probably the "close" and "open" *e* sound ("met," "they") were represented in Greek by *ε* and *η* respectively [ETA]; but in modern Greek *eta* has the sound which in English is expressed by *è* or *ee*, and in French and German by *i*. The letter E is of more frequent occurrence and is more variously sounded than any other in English. It is often mute. This is due partly to the fact that, as in French, the final *e* was often dropped in the 16th century but still written, and partly to the fact that other words

were written with final mute *e* by false analogy with those in which the symbol had survived the sound. In *Music*, *E* is the third note of the scale of *C*. The *E* proposition in *Logic* is the universal negative.

Eadmer, a Canterbury monk of the 12th century, was a friend of St. Anselm and of his successor. In 1120 he was invited to Scotland to become Bishop of St. Andrews, but returned to Canterbury owing to a disagreement with the King of Scotland with regard to his consecration. He wrote *Historia Norwicum*, *Vita Anselmi*, and notices of SS. Dunstan, Bregwin, and Oswald.

Eads, JAMES BUCHANAN (1820-1887), an American engineer, was born in Indiana. He invented boats for raising sunken ships, and in the War of Secession built several ironclads for the Federal Government. In 1867 he built a steel bridge over the Mississippi at St. Louis, with a central span of 520 feet. He suggested the ship-railway, and he did much towards improving Mississippi navigation.

Eagle, a name for any of the *Aquilinae*, a cosmopolitan sub-family of *Falconidae* (q.v.), containing 31 genera, with 94 species, of raptorial birds longer than, but much inferior in courage to, the true falcons. The head and neck are feathered, and the bill is not toothed. The nine species of the type-genus *Aquila* from the Nearctic, Palearctic, and Ethiopian regions and India, have the shank more or less completely feathered, and the edges of the upper mandible are indented. They frequent high cliffs and rocks, and prey on smaller birds, mammals, and sometimes, when better food is scarce, on carrion. The best-known species, and the only one ranging to America, is the Golden Eagle (*A. chrysaetus*), now almost extinct in Britain, though some are preserved in the extreme north of the island. The male is about 30 inches, and the female about 3 feet in length. The general plumage is brown, with a tawny or golden tinge on the neck, whence the popular and specific names are derived. A good deal has been written about the "nobility" of this bird; but its true character is thus sketched by Macgillivray:—"Like other robbers of the desert he has a noble aspect, an imperative mien, a look of proud defiance; but his nobility has a dash of clownishness, his falconship a vulturine tinge. Still, he is a noble bird, powerful, independent, proud, and ferocious, regardless of the weal or woe of others, and intent solely on the gratification of his own appetites; without generosity, without honour, bold against the defenceless, but ever ready to sneak from danger. Such is his nobility, about which men have so raved." The Imperial Eagle (*A. imperialis*), the Russian Eagle (*A. mogilnik*), and the Spotted, or Screaming, Eagle (*A. maculata*) are found on the European Continent. The name Crested Eagles, or Eagle-Hawks, is sometimes given to birds of the genera *Spizaetus*, from the tropics of both hemispheres, and *Morphnus*, from tropical

America, though the latter belongs to the Buzzards, as does the Harpy Eagle (q.v.). In some species of *Spizaetus* and in the single species of *Morphnus* there is an erectile crest. [BATELEUR, ERNE, HARRIER EAGLE, OSPREY.] The eagle was the sacred bird of the Greek Zeus and of the Roman Jupiter, and figures in many other mythologies, generally as an emblem of the sun. The myth of its renewing its youth is very widely distributed. Its powers of sight and of wing have caused it to be taken as a symbol of high and heroic qualities. In Christian art it typifies St. John the Divine, and a figure of an eagle is often used as a lectern in churches.

Eagle, a gold coin of the United States of the value of ten dollars, and at present of the standard legal weight of 258 grains. Taking the dollar at 4s. 1½d., it is equivalent to £2 1s. 3d. English. Its name, of course, is derived from the fact that the American eagle is stamped on its obverse. Double, half, and quarter eagles are also coined, and in the earlier days of the Republic all these coins were sometimes issued by private persons, as well as by the Government.

Eagle Hawk. [EAGLE.]

Eagle Owl. [OWL.]

Ear. The ear is usually described as consisting of three parts:—(1) The *external ear*, which includes the pinna, auricle, or lobe of the ear and the

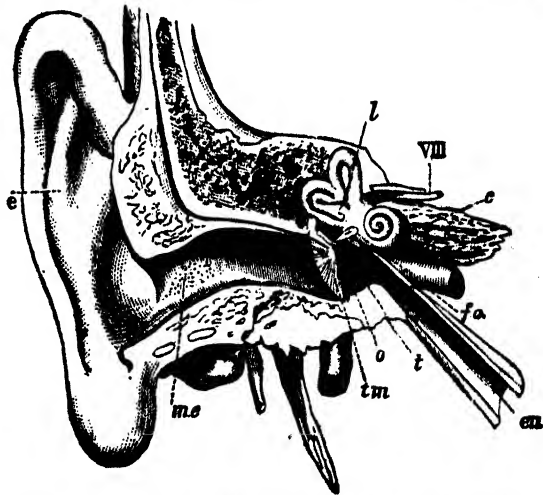


Fig. 1.—THE SEVERAL PARTS OF THE ORGAN OF HEARING (EXPOSED FROM THE FRONT).

e, External ear; me, external auditory meatus; l, bony labyrinth; VIII, auditory nerve; c, cochlea; fo, fenestra ovalis; eu, Eustachian tube; t, tympanum; o, auditory ossicles; tm, tympanic membrane.

external auditory meatus; (2) the *middle ear* or tympanic cavity; and (3) the *internal ear*.

1. The pinna or auricle consists of a framework of elastic cartilage, upon which the skin is moulded.

Names are given by anatomists to the different parts of the auricle; thus, the central hollow is termed the concha, the prominence in front of this the tragus, the ridges situated posteriorly are the helix and anti-helix, and so on. The auditory meatus is directed inwards and slightly forwards, and is closed internally by a membrane called the tympanum. The total length of the external auditory meatus from the concha to the tympanum is about an inch and a quarter; its outer portion is composed of cartilage, its internal part of bone.

2. The middle ear occupies a cavity in the petrous portion of the temporal bone; the tympanic membrane forms the outer wall of this cavity. Internally, the middle ear is placed in direct communication with the pharynx by the Eustachian tube; bounding the cavity posteriorly are the mastoid cells. Within the middle ear are the minute bones, which are known as the auditory ossicles; these ossicles are three in number, and are called the malleus, incus, and stapes. The malleus or hammer bone is attached by one of its processes (the handle of the hammer) to the tympanic membrane; the head of the hammer articulates with the incus or anvil bone, and this latter is attached to the stapes or stirrup bone; the base of the stapes fits into a small opening on the inner wall of the cavity of the middle ear, called the fenestra ovalis. This arrangement ensures the transmission of vibrations of the tympanic membrane to the base of the stirrup, and, as the fenestra ovalis is situated between the middle and internal ears, any movement of the base of the stirrup is communicated to the fluid of the internal ear, which bathes the inner

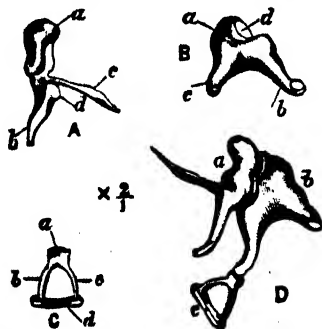


Fig. 2.—AUDITORY OSSICLES OF MAN (LEFT SIDE).

A, Malleus. a, head; b, handle; c, slender process; d, short process. B, Incus. a, the body; b, long process; c, short process; d, articular surface for head of malleus. C, Stapes. d, the base. D, The foregoing in their natural position. a, malleus; b, incus; c, stapes. (Twice natural size.)

wall of the fenestra ovalis. Thus, every movement of the membrana tympani throws into vibration the fluid of the internal ear. Beneath the fenestra ovalis there is a second window connecting the cavities of the internal and middle ears; this window is round, not oval, in shape, and is called the fenestra rotunda.

3. The internal ear consists of a cavity surrounded by a dense bony framework, known as the

osseous labyrinth. This framework encloses a sac, which is called the membranous labyrinth. In the space included between the osseous and membranous labyrinths is a fluid, called perilymph, while the fluid contained within the membranous labyrinth itself is called endolymph. The osseous labyrinth is made up of three parts—the vestibule, cochlea, and semicircular canals.

The vestibule is situated between the cochlea anteriorly and the semicircular canals behind; its



Fig. 3.—COCHLEA WITH PART OF ITS WALL REMOVED. a, central pillar; b, spiral partition; c, scala tympani; d, scala vestibuli.

inner wall is pierced by the auditory nerve, and on its outer wall are the two windows (the fenestra ovalis and the fenestra rotunda) already alluded to.

The semicircular canals are three in number (anterior, inferior, and horizontal); each canal presents a dilatation at one point, which is called the ampulla.

The cochlea is shaped like the shell of a snail, and is formed by a spiral canal which winds two and a half times round a central axis. If the cochlea be divided through the middle, it is found that the spiral canal throughout its whole length is divided into compartments, known as the scala tympani and scala vestibuli, which communicate at the apex of the cochlea by a small aperture, the helicotrema. In the fresh state a small portion of the scala vestibuli is separated off by a membranous partition forming the scala media, in which is found a very complex structure which runs spirally round the axis of the cochlea, supported upon the basilar membrane of the scala media, known as the organ of Corti. This last-named structure consists of a series of internal and external pillars known as the rods of Corti, which form the walls of a tunnel running spirally round the axis of the cochlea; the tunnel supports a series of cells, furnished with minute hairlike processes, called the inner and outer hair cells; these hair cells are supposed to be in direct communication with the terminal fibrils of the auditory nerve.

Physiology of Hearing. The function of the external ear is to transmit and conduct the vibrations of the air to the membrana tympani; the vibrations of this last-named structure are, as has been seen, propagated by means of the auditory ossicles to the fluid of the internal ear, and finally the disturbance reaches the organ of Corti. The exact manner in which the physical disturbance leads to the production of impressions of sound is not understood; it is supposed that the part played by the cochlea is an essential one, and the air cells are usually credited with being the sound-perceiving

organs. The semicircular canals seem to have a special and very peculiar function; it appears from experiments which have been made upon pigeons that injury to these structures is followed by a loss of the power of co-ordination of muscular movements, and it is supposed that variations of pressure of the fluid within the semicircular canals produce sensations which convey to the mind the means of forming a correct idea as to the position of the head with respect to external objects. When the semicircular canals are injured, the sense of position is on this hypothesis lost, and a disturbance of equilibrium is apt to result. The function of the Eustachian tube is probably that of regulating the pressure of air in the tympanic cavity.

Earl, the name of the third rank in the English peerage, as well as of the "courtesy title" borne by the sons of marquises, and occasionally of dukes. In Anglo-Saxon England we find the words *eorl* (earl), and *ceorl* (churl), respectively used for the noble and the non-noble, but free man. According to Professor Freeman, "they mark the distinction of gentle and simple." This nobility, however, was supplanted by the nobility of *thegns* (thanes), or *comites* (the king's companions in war, attached to him by a special and personal tie, and commonly holding some office under him). Under Cnut the term was taken to denote the under-kings of the divisions of England, and made to correspond to the foreign term count or *comte* (comes), the equivalent of the *thegn*. An earl, in fact, was the governor of a county as the ealdorman had been in Anglo-Saxon times. Under the Norman kings the earl or count was still such a governor, but the title gradually became dissociated from official rank. Sometimes it passed by inheritance, sometimes by marriage, sometimes both title and office were suspended by the Crown. Edward III. created earls as a hereditary rank, and this, of course, helped to make the dignity purely titular. An earl's wife has the foreign title of "Countess." The earl's coronet is composed of eight golden leaves, connected together into a wreath; between each pair rises a golden spike or ray topped by a pearl. The countess's coronet is precisely similar. The earl is styled "Right Honourable," and commonly addressed by the Crown in official documents as "our trusty and well-beloved cousin." His sons are "Honourable," his daughters "Ladies" by courtesy. [DUKE.]

Earle, WILLIAM (1833-1885), an English military officer, was born at Liverpool. He entered the army in 1851, and fought in the Crimea. He was military secretary to the Governor-General of India (1872-76), and commanded the garrison of Alexandria (1882-1884). He was killed in the Gordon Relief Expedition while engaged in storming some Arab entrenched positions. He had attained the rank of major-general.

Early English Style, THE, in the history of English architecture followed the Norman Style, and prevailed for about a century (between 1185 and 1300). It first appears during the building of Canterbury cathedral, and the choir and transepts of Rochester cathedral are an early instance. As

compared with the Norman Style, it exhibits great lightness; long, narrow lancet-shaped windows and sharply-pointed arches take the place of the Norman round arch, and slender pillars (often formed of a cluster of shafts bound together at intervals) take the place of the thick heavy Norman pillars; while the vaulting is much lighter, and there is a marked prevalence of vertical lines. Flying buttresses, bold, rounded mouldings, and crockets (ornaments resembling a shepherd's crook) are also among the characteristics of the style. The lancet-headed windows of the earliest examples are modified later on by the introduction of tracery, usually in the form of circles. The choir and apse of Westminster Abbey, much of Wells cathedral and the bishop's palace, the choir of Worcester cathedral and the Temple church, London, and the nave of Lincoln Cathedral are among the best-known examples of this style, but Salisbury cathedral is its leading type.

Earn. A river and loch of South Perthshire, Scotland. The loch is 26 miles W. of Perth, and is 7 miles long by $1\frac{1}{2}$ wide, and is 600 feet deep, and has picturesque scenery by reason of the high mountains which surround it. The river debouches from the east end of the lake, and flows through the beautiful and fertile Strathearn into the Tay, one mile below Abernethy, after a course of 46 miles. It is navigable for 4 miles. Salmon and trout are plentiful. Bridge of Earn is four miles S.E. of Perth.

Earring, an ornament hung from the ear, usually by a hook, which the lobe is pierced to receive. Occasionally in the East it has been worn singly, but usually both ears are ornamented. Their use is ancient and widespread. They were worn by the ancient Egyptian and Hebrew women as well as by those of Greece from the Homeric age downwards (the Venus of Medici has her ears pierced), while they have often been found in Norse and Anglo-Saxon tombs. In the East they are worn by both sexes. Foreign sailors occasionally affect them, and they are seen in one of Shakespeare's portraits. Popularly they are supposed to be good for the sight, presumably as counter-irritants when the eyes are at all inflamed. This idea, however, has no satisfactory evidence in its support.

Earth, the name given to that member of the solar system on which we live. Travelling periodically round the sun it is classed among the planets. Its orbit is therefore an ellipse, in accordance with Kepler's laws of planetary motion, with the sun at one focus of the curve. The plane containing this ellipse is called the *ecliptic*, shown by a great circle on the celestial sphere. Its speed depends upon the solar distance, being greater when this distance is a minimum, and least when we are farthest from the sun. The average distance as estimated by observations on transits of Venus is 92,800,000 miles. A difference of over 3,000,000 miles exists between maximum and minimum solar distances, the positions of which are called aphelia and perihelia respectively. The average rate of motion is over 65,000 miles an hour, the whole

orbit being accomplished in one year. The elliptical orbit is subject to various perturbations (q.v.), on account of the attractions of the other heavenly bodies.

The earth has one satellite, the Moon (q.v.), which travels round the earth once a month in an elliptical path at an average distance of 238,000 miles. The exact length of the ordinary calendar year is 365 days 5h. 48m. 46s. This differs from the length of time taken for the orbit to be completely traversed, the difference being due to what is called the *precession of the equinoxes* (q.v.). This interval is known as the *sidereal year*, and is 365 days 6h. 9m. 8s. The earth's orbit is also gradually veering round towards the east, and if the time be taken from one perihelion to the next, the *anomalous year* is obtained. This is about 365 days 6h. 13m. 48s.

Before giving the other motions of the earth, it is necessary to describe its shape. Like all other planets, it is a solid of revolution, being a sphere that has undergone a slight flattening at the opposite extremities or *poles* of the axis of revolution. More accurately, it is an oblate spheroid (q.v.), generated by the rotation of an ellipse about its minor axis. Such a figure would be assumed by a sphere of liquid rotating about a diameter, centrifugal force acting most vigorously at the equator, and tending to overcome the internal forces that keep the molecules together. The smallest diameter of the earth is that measured from pole to pole along the axis of rotation; this is 7,899.6 miles, or about 500,000,000 inches. The greatest diameters are those measured between opposite points on the equator; these are 7,926.6 miles, and, therefore, show that the *eccentricity* of the earth, or the extent of its departure from the perfect sphere, is very slight.

The circumference of the earth, measured along the equator, is 24,899 miles; the area is 197,000,000 square miles; and the volume is 260,000,000,000 cubic miles. Experiments on the comparative attraction of the earth [CAVENDISH EXPERIMENT] show that its density is about $5\frac{1}{2}$ times that of pure water at 4° C. Its mass is, therefore, approximately 6,000 trillion tons, a trillion being 10^{12} . (For ancient beliefs concerning the disposition of the earth and its neighbours, see *PTOLEMAIC SYSTEM*.) The ordinary proofs of the sphericity of the earth are—(1) It can be circumnavigated; (2) the appearance of a vessel at sea always indicates a nearer convexity of the earth's surface; (3) the sea-horizon is always depressed equally in all directions when viewed from an elevation; (4) the elevation of the pole-star increases as we travel northwards from the equator; (5) the shadow of the earth on the moon during a lunar eclipse is spherical.

The earth rotates uniformly about its axis. The time taken to make a complete revolution of 360° is called a *sidereal day*, for it is the interval of time between consecutive transits of any distant star across any meridian of the earth. The time between consecutive transits of the sun across any meridian is called a *solar day*; the average of these throughout the whole year is called a *mean solar day*, and is the practical standard of time (q.v.) adopted by civilised nations. The ordinary proofs that the earth

rotates are—(1) Bodies falling from a great height have an easterly deviation; (2) Foucault's pendulum experiment (q.v.); (3) a gyroscope delicately balanced so as to be free to change the direction of its axis in any way will, if rotated, exhibit an apparent deviation; (4) in northern hemispheres a projectile deviates to the right, in southern hemispheres to the left; (5) the trade winds (q.v.); (6) Dove's law of wind-change (q.v.).

The speed of a body on the equator, due to the diurnal rotation, is about 1,000 miles an hour. The centrifugal force due to this speed diminishes the weight of bodies; if the earth rotated in an hour, they would be thrown off from the surface at the equator.

The axis of the earth is not perpendicular to the ecliptic, but at angle of 66° 32' to it; the equator is, therefore, inclined to it at an angle of 23° 28'. This unsymmetrical placing of the bulging portions of the earth causes a slow wobbling, or *precession* (q.v.), of its axis, in the same sort of way as a spinning top will wobble when pushed over on one side. There is also a slight vibration or "nodding" motion of the earth's axis, known as *nutation* (q.v.). The period of each precession is about 21,000 years; if the earth's orbit occupied a constant position in its plane, the periods would be 26,000 years each. These motions have considerable influence on climate, the modern theories of the Ice Age being connected with the known facts of precessional motion.

The earth's temperature increases from the surface downwards at the rate of about 1° C. for every 100 feet of descent; this law does not hold for sea-depths, deep sea temperatures never exceeding 5° C. The phenomena of volcanoes, *geysers*, and earthquakes also point to a high internal temperature, and it is believed that the earth is gradually cooling down from a past condition of incandescence, more heat being lost from its surface every year by radiation than is received by the sun. It is probably solid throughout, the extreme internal pressure preventing liquefaction or vaporisation until restraint is removed and some outlet afforded. In fact, the rigidity of the earth must be comparable to that of steel in order to withstand with so little distortion the various gravitational and other stresses to which it is subjected.

Only the 2,000-millionth part of the sun's heat reaches the earth, and part is immediately reflected back into space. Seasons (q.v.) are due to variation in the obliquity of the sun's rays during the year, and to variation of its distance from the earth. Climate undoubtedly depends also on the lengths of summer and winter, using these terms to denote the two portions of the year into which it is divided by the equinoxes (q.v.). It must be understood that any hemisphere of the earth receives half the solar heat that arrives during a year. The summer in the northern hemisphere will, therefore, happen at the same time as the winter in the southern hemisphere, and conversely. It has been proved that so long as the obliquity of the ecliptic remains at its present value, of the total heat received from the sun in one year on a hemisphere, 63 per cent. is received during the summer and 37 per cent. in the winter. This is the case whatever be the shape of the earth's orbit

or the position of the line of equinoxes. But this line alters the number of days in summer and winter, and its position will, therefore, affect the intensity of heat distribution during the summer or winter-days. The 37 per cent. winter-supply distributed over a long winter of 199 days is what obtains during the glacial epochs of the earth's history; whereas the 37 per cent. distributed over a short winter of 166 days is the case during the general epochs. At present the northern hemisphere is in an intermediate condition, its winter being of 179 days.

(Concerning the gaseous envelope of the earth, see ATMOSPHERE.)

Earth Houses, the general name for curious pre-historic structures, found chiefly in Scotland, but occurring also in Ireland and in Cornwall, whence their Celtic origin has been inferred. The general plan is a curved subterranean gallery, in some cases more than 60 feet long, widening from the opening, and sometimes chambered. The walls are lined with dry masonry, converging towards the top, which is covered in with large unhewn slabs, these being but little below the surface and often uncovered by the plough. Some of these structures, from the relics found in them, appear to have been occupied down to the period immediately after the Romans quitted Scotland. They may have been receptacles for plunder, or places of shelter from the inclemency of the weather before houses were built, or of concealment from an enemy. It is noteworthy that Tacitus (*Germania*, xvi.) describes somewhat similar structures as existing among the Germans.

Earthquake, a sensible tremor of the earth's surface as if from a concussion at some definite underground centre. Earthquakes are the subject of the science of *seismology* (from the Greek *seismos*, an earthquake), the earliest English work on which is *Hooke's Discourse on Earthquakes*, 1668. Attention was more directed to the subject by the Lisbon earthquake of 1755; but little is even yet known as to the cause of the phenomena.

Probably several distinct causes bring about similar results. Most earthquakes occur in proximity to volcanic centres, and most volcanic eruptions are preceded by earthquake shocks, suggesting a community of origin for the two sets of phenomena. The sudden flashing of percolating water into steam on reaching highly-heated rocks, is proposed as a sufficient cause for both. Landslips produce tremors in non-volcanic areas resembling earthquakes, and the falling-in of the roofs of subterranean cavities has also been suggested as a cause, but is only likely to affect a small area. The sudden snap and dislocation of rock-masses under pressure producing a "fault" (q.v.), or the crushing together of such masses under the tangential pressures produced by the secular cooling of the globe, are suggestions of wider-reaching causes.

Professor Alexis Perrey of Dijon finds earthquake shocks more numerous about the winter solstice, i.e. when we are in perihelion, at apogee, and when the moon is on the meridian, suggesting their connection with a tidal action on the earth's interior.

The centre of origin of the concussion, whatever it be, is known as the *seismic centre* or *focus*, a point on the earth's surface vertically above it (where the shock will be first and generally most severely felt), being termed the *epicentrum*, whilst the line joining them, the length of which is the depth of origin of the concussion, is called the *seismic vertical*.

The so-called shock is in reality the culminating of several undulatory movements of increasing intensity, and is followed by a diminishing series. These shocks consist in successive "waves of elastic compression" transmitted through the solid earth, much as sound is transmitted through the air. In addition to the "longitudinal vibrations," or forward and backward movement of rock-particles in the direction of the transmission of the shock, there are "transverse vibrations," which tend to make the effects more complex, as, for instance, in rotating chimney-stacks without overturning them. The actual distance through which individual particles oscillate, the amplitude, that is, of the undulation, in spite of the enormously destructive effects of some earthquakes, is probably generally less than an inch. The rate of transmission of the shock depends upon the density and elasticity of the various rocks, etc., through which it passes. Mr. Robert Mallet, the first of our modern seismologists, and his son, Dr. J. W. Mallet, determined by experiments with gunpowder explosions that such shocks travelled through damp sand at a velocity of about 825 feet per second, and through solid granite at 1,665 feet per second. The shock seems to undergo partial reflection, and perhaps refraction, in passing from one medium to another of differing elasticity, as from one geological formation to another, from land to water or *vice versa*. This may result in a local doubling of the effects by the reflected wave, and in the formation of an area of *seismic shadow* enjoying relative or complete immunity from harm. The points at which a wave-shell reaches the surface form a curve called a *co-seismal line*, along which the shock is felt simultaneously; but, owing to the varying conductivity of the heterogeneous materials of the earth's crust, this curve is not a circle, in other words the wave-shells are not concentric spheres, and the *co-seismic points* are not equidistant from the epicentrum.

The earthquake produces an atmospheric wave which will travel at the ordinary velocity of sound-waves, viz. 1,100 feet per second. It has often been recorded as a rumbling noise like thunder or cannon. On reaching the sea or other large body of water the shock produces two waves: one slight one, travelling with the earth-wave along the bottom; the other, with less velocity and of a height dependent on the depth of the water, rolling in after the earth-wave, often with most fatal effect, as at Lisbon in November, 1776, and at Arica, in Peru, in August, 1868, and in May, 1877.

Mr. Mallet was of opinion that the *angle of emergence* of the shock could be ascertained from cracks in masonry, the general direction of which might be expected to be at right angles to the direction of transmission; but, apart from

such difficulties as the zigzag character of most of such cracks and the manifestation of pre-existent weaknesses in the structures, the transverse vibrations have been proved to render all such conclusions untrustworthy. Could we determine the angle of emergence, knowing our distance from the epicentrum, it would be easy to calculate the depth of the focus, and Mr. Mallet was of opinion that this was not likely to exceed 30 miles.

Besides overthrowing buildings, earthquakes frequently produce landslips (q.v.) or subsidences, alter lines of drainage, and affect springs. Only occasionally do fissures open; but they may engulf houses and human beings, or, remaining open, may be widened by other agencies into ravines.

The area affected by earthquake is very variable. That of Lisbon was felt over a region four times the area of Europe, Lake Ladoga and Loch Lomond rising and falling, the springs at Toplitz and at Bristol being affected, and that at Luchon in the Pyrenees becoming permanently warmer. The Arica earthquake was felt 2,000 miles off; but, on the other hand, destructive shocks on the islands of Casamicciola in the Bay of Naples, and Scios in the Archipelago, were hardly noticeable on the mainland.

Various *seismometers* and *seismographs*, or instruments for recording the duration, direction, and intensity of earthquake shocks have been devised. Mallet suggested a tub rubbed over with chalk inside and half filled with water. In Italy a vessel containing mercury is employed, eight openings, with cups to receive overflow, being disposed round its margin. A suspended helix of copper wire may, on dipping into the mercury, complete a galvanic circuit, ringing an alarm-bell, stopping a clock to indicate the commencement of the shock, and starting another so as to indicate its duration. Another instrument consists of two rows of wooden cylinders of equal height, but different in diameter, arranged on two planks at right angles to one another on a surface of sand, to prevent their rolling when overturned. Other instruments consist of pendula vibrating in different planes over bowls lined with chalk or lamp-black, and much valuable information as to the direction of earthquake shocks may be obtained by merely noting the orientation of pendulum-clocks which may happen to be stopped by the shock striking them obliquely to their plane of vibration. Unfortunately, careful observations made in Japan, where earthquakes are frequent, have yielded most contradictory results.

Earths. The early alchemists recognised four "essences" or "elements." Of these *earth* was one. The term "element" had not, however, the same definite meaning then that it obtained amongst chemists of later times. The name was afterwards applied to such substances as were unacted upon by heat or by water. Since lime and other kindred bodies showed great resemblance to the ordinarily known earths, they also received the same title, but as they gave a basic solution in water they were distinguished as "alkaline earths." These were shown to consist of oxides of metals, and, although many of the substances previously called earths do not fall in this class of bodies, the term was

restricted to infusible, insoluble oxides. At the present time the word is not of great usage in chemical literature, being applied to the oxides of certain metals which, though some occur plentifully, as calcium, barium, aluminium, are for the most part found in but small quantities, as cerium, lanthanum, iridium.

Earthworks, in *Engineering*, is a term applied to cuttings or to embankments; to the removal of earth as in the cases of canals, trenches, docks, or railway cuttings, or to the systematic deposition of the same, as in the cases of earth-dams, elevated canals, or railway embankments. The general methods of executing earthwork are similar in most applications of the work. In the formation of a railway over irregular ground, the elevation is usually chosen so that the amount of cutting shall be approximately equal to the amount of embankment, the earth obtained from the former being conveniently discharged where required for the latter. The work is proceeded with continuously, the full height of the railway at any one place being reached before the further excavation or embankment is begun. This renders the laying-down of rails convenient, and the material can therefore be easily shifted in waggons, etc. Steam excavators are much used, and their transit from place to place requires the rails. The angle of slope of a cutting for embankment depends upon the nature of the ground. Chalk may be at a very steep angle or *batter*, but a moist, loose, gravel soil requires an easy slope, the angle of repose (q.v.) of that material being so small. Continual vibration, such as that produced by passing railway trains, may in course of time affect their stability, as also may inefficient drainage, or alternation of extremes of temperature. The amount of earthwork of any such undertaking requires careful calculation, but in the case of those with the ordinary trapezoidal section the estimation is easy. The sectional area is then obtained by multiplying the depth of the section by the average of the top and bottom widths; the cubic contents of any length of such an earthwork is the product of that length and the sectional area.

Earthworm. The common earthworm, *Lumbricus terrestris*, is a very convenient type to serve as an introduction to the study of the worms, as its anatomical structure is fairly easily made out by dissection, and it is so extremely common. It belongs to the class Oligochaeta (q.v.). When examined externally, the earthworm is seen to consist of a long cylindrical body, divided into from 100 to 200 cylindrical rings or segments by means of well-marked furrows. The mouth opens on the second of these rings, and the segment in front of it is a small conical point known as the "prostomium"; the anus is situated at the extreme posterior end. The body tapers sharply to a point at the anterior end and more gradually posteriorly; the rest of the body is of a uniform diameter except for segments numbers 31 to 38, counting from the front end; these are expanded by a number of glands into a region known as the "clitellum," the function of which is the formation

of the cocoon by which the eggs are united into masses. Running along each side of the ventral aspect of the worm is a pair of faint raised lines; on each of these during its passage across a segment a pair of small bristles or setæ occur; these are very fine, and are often lost; they represent the strong conspicuous setæ of the Polychæta (q.v.). If the earthworm be cut open, the dorsal side of the body cavity will be found to be divided into a number of separate chambers by vertical partitions or dissepiments, which correspond in position to the depressions which mark off the somites. The digestive system consists of one long tube running straight from the mouth to the anus; immediately behind the mouth it expands out into a large "pharynx," occurring in the first five somites; this is continued as a narrow tube, the œsophagus, which dilates into the crop in the 16th and 17th somites; behind this occurs the gizzard, and then comes the long straight simple intestine; as this is straight, instead of convoluted, additional internal digestive and absorbent surface is obtained by an infolding of the upper side of the wall, known as the "typhlosole." There is no distinct heart in the earthworm, but there is a complex series of blood vessels. The largest of these is the "dorsal," and runs along the upper side of the alimentary canal; it is connected by numerous lateral vessels with smaller longitudinal canals on the under side. The nervous system consists of a distinct "ganglion" above the mouth; a pair of lateral nerves pass from this one on each side of the pharynx, and unite below in a pair of ganglia in the second somite; thence a long cord passes backward through the length of the worm on the under side; in each segment it expands out into a distinct ganglion. The renal organs or "nephridia" occur as a pair in each somite in all except the first three. One end is a funnel, on the margin of which occur long lashing cilia; this funnel floats freely in the fluid which fills the body chambers; it leads into a long narrow tube which passes through the diaphragm between the two somites, and opens to the exterior in the next posterior somite. The reproductive organs are included in the 10th to 15th somites; the earthworms are hermaphrodite, male and female organs occurring in the same individual. Organs of special sense are very imperfectly developed; earthworms are blind, but can distinguish between light and darkness; they are also completely deaf, and have but a feeble sense of smell. Their sense of touch is, however, very well developed. Earthworms live, as a rule, burrowing through mould and soil containing much decaying vegetable matter. They carry leaves into their burrows, prepare these for food by covering them with a saliva, which partly digests them before they are actually eaten (extra-stomachal digestion). The main food of the earthworms is, however, obtained from the soil through which they burrow; the earth removed is swallowed, the organic matter in it is absorbed, and the excreta discharged, forming the casts found about the entrances to worm burrows. The earthworm thus constantly raises parts of the soil to the surface; in suitable soil they exist in great numbers. Hensen calculated the

number at over 50,000 an acre. The influence of worms in rearranging the soil is very considerable; as has been observed, they carry down leaves to line their burrows, and thus act as fertilising agents; by gradually removing the soil from under stones, etc., and piling it up around them, they ultimately bury and preserve them. The part played by earthworms is thus an exceedingly important one. In some tropical districts where the soil is unsuited for worms, the white ants (*Termites*) play their part.

Earwigs, a family of Orthoptera (q.v.), known as the *Forficulide*, of which *Forficula auricularis* (L.) is the commonest English species. The popular name is derived from the fact that specimens have at times managed to get into the ear. The eggs are watched with great care by the parents. The earwigs live mainly on plants and flowers.

Easement. An Easement is the right which the owner of one piece of land, technically called the dominant land, has in respect of his ownership, by virtue of which right the owner of another piece of land, technically termed the servient land, is necessitated to allow the owner of the dominant land to do something on the servient land, or something which has relation to that land, or is himself obliged not to do something on that land, and this power possessed by the owner of the dominant land or this duty to forbear on the part of the owner of the servient land, must be something that is for the benefit of the owner of the dominant land. Easements are very numerous, and are classed as public and private; they are principally the right to air, light, common, water, and passage. By the "Prescription Act" passed in the second and third years of the reign of William IV. (2 and 3 William IV., c. 71), an uninterrupted enjoyment of rights of common and all other profits or benefits to be taken and enjoyed from or upon any land for 30 years shall not be defeated except by showing that it was without the knowledge of the adverse party, or that it was by his mere licence or permission, and after an enjoyment of 60 years the claim is indefeasible, except it can be shown that such enjoyment was under consent or agreement in writing.

Eastbourne, a municipal borough town and parish on the south coast of Sussex, between Brighton and Hastings, and 66 miles S. of London. It has lately become a highly fashionable watering place, and the landowners and local authorities have done much towards improving, beautifying, and developing it. It has the benefit of shelter, while a short walk enables one to get the invigorating breezes of the South Downs, and on the other side of the Downs may be found charming scenery. Close by is Beachy Head. The town has broad streets, and is well furnished with trees, and on the sea-front is a parade of two miles, with three tiers of terraces ornamented with plants. There is a theatre, and the golfers have links. Roman remains have been found, and the place is mentioned in Domesday. There is an interesting twelfth-century church. The town was made a borough in 1883. Pop. (1901), 43,537.

East Cape, the name of several capes, among them being those in New Guinea, Madagascar, New

Zealand, and Siberia—the last, on Behring's Straits, being the east point of Asia.

Easter, derived by Bede from the name of an Anglo-Saxon goddess Eostre or Eastre, the personification seemingly of the dawn, whose festival fell on the vernal equinox; by others, with less probability, from the Anglo-Saxon *oster*, to rise; the chief festival of the Christian Church, commemorating the resurrection of Christ. Part of the ceremonies of the heathen festival lasted on in the Celtic celebrations of Beltane; and the Easter egg, symbolising life out of death, had probably a naturalistic before it had a theological meaning. All the other Church festivals are fixed by the date of Easter, which is determined in a manner to be found in the tables prefixed to the Anglican Prayer-Book, and based on the Metonic cycle. In the early Church the method of its determination caused much controversy. Some kept it on the traditional anniversary of the Resurrection, *i.e.* on a different day of the week in successive years; others on the fourteenth day of the first moon in the year, which began in March—these were called Quartodecimans; others on the first Sunday after the first full moon in the year. The authority of St. Philip and St. John was alleged for the second method, which was adopted by the Eastern Church; that of St. Peter and St. Paul for the third. The Quartodecimans adopted Jewish practices, which were regarded as heretical; and a bitter controversy arose, which was settled by the decision of the Council of Nicea in 325 A.D., that Easter should fall on the first Sunday after the first full moon on or after March 21. It cannot, therefore, fall before March 21 or after April 25. The name is often extended to the customary holidays before and after the day. The inconvenience resulting from their fluctuation has led to the cry for a "fixed Easter."

Easter Island, in the Pacific, in lat. 27° S. and long. 109° W., is a volcanic island of 47 square miles. It is remarkable as having some stone houses and stone statues of peculiar appearance, with inscriptions as yet undeciphered, which seem to indicate a degree of very ancient civilisation. It derives its name from the fact of its discovery upon Easter Day, 1722. It was visited by Captain Cook in 1773.

Eastern Question, in European politics, primarily, the question of the fate of the dominions of the Sublime Porte after the fall of that power. Though the Turkish Empire was considerably encroached on by Russia and Austria in the 18th century, the modern Eastern Question may be said to date from the battle of Navarino (q.v.) in 1827 and the conflict between Turkey and Mehemet Ali, the Viceroy of Egypt, in 1833, during which Russia and Turkey bound themselves in the treaty of Unkiar Skelessi (July, 1833) to a close mutual alliance—Russia, however, binding herself not to make any present demand for aid to Turkey, and the Porte in return undertaking to close the Dardanelles, should Russia be at war, to ships of all other nations. This treaty was set aside, however, through the intervention of the Western Powers. In 1844 the Czar Nicholas visited England to sound Ministers as to

what was to be done, seeing that, in his own phrase, the Porte was "a sick man who cannot live long." In 1853, on the occasion of the disturbances in connection with the Holy Places which led to the Crimean War (q.v.), he suggested a partition of Turkey. The formal restoration of Turkish power by the Treaty of Paris (1858) after the Crimean War unfortunately kept the question open. Among the chief crises in the history of the question since 1859 are:—the union of the Danubian principalities in 1859; the occupation of the Lebanon by France in 1860; the rising in Crete (1864-66); the "tearing up of the Black Sea Treaty" (preventing Russia from maintaining warships there) by that power in 1870, during the Franco-German war; the Russo-Turkish war in 1876-78; the Treaty of Berlin in 1878; the union of Bulgaria and Eastern Roumelia (1885); the fall of Prince Ferdinand (1886), and the threatened war between Greece and Turkey in the same year; the Armenian atrocities (1895); the Greco-Turkish War (1897). From the time of the Crimean war the question has become complicated with the alleged designs of Russia on the British Empire in India and her progress in Central Asia.

East India Company, THE, was founded in 1600, and obtained a charter from Queen Elizabeth, granting it exclusive rights of trade between England and the East. In 1612 it established its first factory at Surat, the starting-point of pilgrims going to Mecca, and an important outlet of the trade of Western India. The "factory" was composed of English traders and clerks, living together, attended to spiritually by an English chaplain, and administered by a president, assisted by some of the leading traders as a council. Hence the "Presidencies" and Councils of the present Government of India. No ladies were permitted in the factory. The Company were much hampered in India at first by the Portuguese, and always, farther East, by the Dutch. In 1620, however, they obtained a footing at Masulipatam; they repelled a Portuguese attack on Surat, and so impressed the Great Mogul; in 1639 they purchased a strip of ground, and built Fort St. George, round which a native industrial population grew up, the nucleus of the present Madras; in 1665 the Surat factory was moved to Bombay, obtained by the Crown as part of the dowry of Catherine of Braganza, and leased to the Company. In 1640 a factory had been established at Hugli, about twenty miles above Calcutta, an important outlet for linen, saltpetre, and silk. This, in 1685, was moved to the present Calcutta, where the sites of some native villages were purchased from the Nawab of Bengal. The Company had to some extent purchased its privileges by gifts to the Crown—thus it helped Charles I. to raise £60,000 for war purposes—and gave presents, though not of large amount, to Charles II. and James II. The right of making war on its own account was granted to it by the former king. The abolition of its monopoly, threatened by Cromwell, was voted by both Houses in 1693, but the disclosures of the bribery by which it had attempted to avert this step were so scandalous that Parliament was hastily prorogued to stop further revelations. In 1698, however, a

rival company was established, but the two were amalgamated in 1708 as the "United Company of Merchants trading to the East Indies," with a capital of £3,200,000, lent to the Government at 5 per cent. For the last half of the 18th century it was but little in conflict with the natives; the enterprise of Dupleix (q.v.), governor of Pondicherry, nearly destroyed its rule. But it was saved by Clive (q.v.) in 1750-52, and Dupleix, repudiated by his government, died in poverty. From Clive's time onward this trading company is gradually converted into the deputy-ruler of India, and the histories of the two are difficult to separate. We find that the Company interferes in the affairs and feuds of native princes; sets its own candidates on native thrones; steps into the place of the native administrators of their dominions, with their consent—thus, in 1765, it became Dewan to the Great Mogul, taking the revenues of Bengal, Berar, and Orissa, and providing for the defence of the provinces, and it took the place of the Great Mogul (in 1771) when he joined the Mahrattas, and so forfeited his suzerainty and the pension paid him by the English Government) as suzerain of feudatory states. The Company, however, as Adam Smith said, "had two incompatible characters—that of trader and that of sovereign." As sovereign, its business was to increase the wealth of the country; as trader, to get that wealth as cheaply as possible. Moreover the officials were corrupt, and traded largely on their own account, and interfered with native production in their own interest. Lord Clive abolished the private trade. [HASTINGS.] In 1783 Fox's India Bill, introduced in consequence of charges of maladministration brought against the Company, proposed to abolish the Court of Directors of the Company, transferring their power and patronage to seven commissioners nominated by Parliament. George III., to increase his own power, was anxious to nominate these commissioners, and, failing to secure this power, put pressure on the House of Lords, and induced it to reject the bill. Under Pitt's India Act in 1784, Parliament controlled the whole administration of the East Indian Empire, a Board of Control was appointed by Parliament, a Governor-General by the Crown, and, while the East India Company made all first nominations in its Civil Service and its army, promotion in India was left to the local governments or to the Governor-General in Council. In 1813 the Company lost its privilege of exclusive trade with India, in 1833 all its monopolies, and the country was thrown open to Europeans without (as hitherto) the requirement of a licence from the Board of Directors. The Governor-General of Bengal was made Governor-General of India, with increased control over Madras and Bombay, and a legal member added to the Council. In 1853 Parliament refused to renew the charter of 1833, which then expired, introduced open competition for first appointments, and gave a representative character to the Legislative Council. Finally, in July, 1858, after the Mutiny, India was transferred to the Crown by Act of Parliament, though the Company existed till 1873 as a medium for the distribution of stock. J. S. Mill strongly opposed the transfer.

East Indies, a name given generally to denote European possessions in India and the Indian Ocean. There are English, French, Dutch, and other East Indies.

Eastlake, CHARLES, SIR, P.R.A. (1793-1865), was born at Plymouth. He studied at London and Paris, and after making two portraits of Napoleon when on board the *Bellerophon*, he lived from 1816 to 1830 in Rome. He became A.R.A. in 1827 and R.A. in 1830, and president in 1850, receiving at the same time the compliment of knighthood. In 1855 he became director of the National Gallery, London. His *Christ Blessing Little Children*, and *Christ Weeping over Jerusalem*, are in the National Gallery. He also wrote upon art, among his works being *Materials for a History of Oil-Painting*.

East London, a town of South Africa, at the mouth of Buffalo river, 32 miles S.E. of King William's Town, and 700 E. of Cape Town. There are harbour works to protect the anchorage, and the town is an outlet and inlet for the district, being the terminus of a railway to Queenstown.

East Main, in Canada, in the N.W., forms great part of the peninsula of Labrador, having on the E. Labrador proper, on the S. the province of Quebec, on the N. Hudson's Strait, and on the W. Hudson's Bay. It is desolate and wild, and produces little beside fish and furs.

East Saginaw, a town of Michigan, 66 miles N.E. of Lansing, and the chief port of the steam navigation upon Saginaw river, which is crossed by several bridges. There are planing- and saw-mills, foundries, machine shops, and shipbuilding yards, and there is a trade in timber.

Eastwick, EDWARD BACKHOUSE (1814-1883), a man of letters, was born in Berkshire, and educated at Charterhouse and Oxford. He went to India as a cadet in 1836, and was soon after appointed political officer. He was Professor of Hindustani at Haileybury College (1845-49), and then became assistant political secretary at the India Office. From 1860-63 he was Secretary of Legation in Persia. He made many translations from Persian, and also translated Bopp's *Comparative Grammar*, and Schiller's *Revolt of the Netherlands*.

Eau de Cologne, a perfume named from the city where first manufactured, is an alcoholic solution of various essential oils, of which the chief are the oils of citron, bergamot, and lavender. The purity of the materials is most important in its preparation, as upon this depends chiefly the fragrance of the perfume.

Eau de Javelle, a solution containing the hypochlorite and chloride of potash, which is prepared by passing chlorine into a solution of potash or into lime-water, and the subsequent addition of potassium carbonate. Owing to the chlorine which is evolved on the addition of a weak acid the liquid may be used for bleaching and disinfecting.

Ebbw Vale, a valley of North Monmouthshire, on the Ebbw Fawr river, 21 miles N.W. of Newport, producing iron and coal. The Ebbw Vale Iron and Coal Company, besides exporting much coal, have

four blast furnaces turning out 1,600 tons a week, and manufacture steel rails and railway iron.

Ebers, GEORG, born at Berlin (1837), a renowned Egyptologist. After studying the subject and visiting most of the European museums, proceeded to the East in 1869, and was appointed the next year Professor of Egyptology at Leipzig. In 1875 he published a papyrus which he had discovered, and which was named after him. He had already published one volume of a work upon the Egyptians and the Book of Moses, and other works, but illness stopped his more serious work, and he then occupied himself in writing novels. He died in 1898.

Ebionites (possibly from the name of their alleged founder, more probably from a Hebrew word = *poor*), a sect of Judaizers in the early Christian Church, described by Zeller as "the Christian successors of the Essenes, who practised Jewish rights, used unleavened bread in their mysteries, repudiated the authority of St. Paul, and denied the divinity of Christ." Their creed shows traces of the dualism common to many pagan and early Christian schools of thought. Gradually they became absorbed in the obscurer Gnostic sects of the 2nd century.

Eblis, the devil of Moslem theology. When God "said unto the angels, Worship Adam, they all worshipped him, except Eblis, who refused, and was puffed up with pride, and became of the number of the unbelievers" (*Koran*, ch. ii.).

Ebonite is formed by the incorporation of sulphur with twice its weight of caoutchouc by means of heat and pressure. As it is hard and takes a high polish it is much used for manufacture of combs, buttons, and other articles, and owing to the fact that it is easily electrified, and a poor conductor of electricity, it is also largely used in the manufacture of electrical apparatus.

Ebony, the heavy and hard heart-wood of various species of *Diospyros*, a genus of the order *Ebenaceæ*, which is either black or brown, durable, and susceptible of polish. The order includes five genera, and about 250 species, upwards of 100 of which belong to the genus *Diospyros*. These are mostly natives of tropical Asia, Mauritius, etc., three or four only being African, and about a dozen American. They are trees with dioecious flowers, and fleshy, sometimes edible fruit. The best black ebony is that of *D. reticulata* of Mauritius. East Indian ebony is *D. melanoxylon* and *D. ebenaster*; Ceylon, *D. ebenum*. The hard, heavy, greenish-brown wood of the shrubby leguminous *Brya ebenus* of the West Indies is known as Jamaica or green ebony. Ebony is used in cabinet-work, inlaying, for knife-handles, rulers, pianoforte-keys, etc., and was valued for its durability by the ancients, and as a supposed antidote to poison. *D. guersita* yields the mottled brown and black Calamander wood of Ceylon: the fruit of *D. kaki* is the kaki, keg-plum, or Chinese date-plum of China and Japan; and that of *D. virginiana*, the persimmon of Virginia and the southern United States.

Ebro, THE (anciently the *Iberus*), the chief river of Spain, rises in the province of Santander

in the Cantabrian Mountains, and flows S.E. through Old Castile, Navarre, Aragon, and Catalonia, falling into the Mediterranean, after a course of more than 300 miles, 80 miles S.W. of Barcelona. Although navigable for 180 miles from the mouth, its course is obstructed by rapids and shallows, to avoid which a canal has been made for nearly 100 miles along the bank, and there is another canal through the delta. The Ebro receives several tributaries.

Ebullition, or **BOILING**, signifies the free passage of the particles of a liquid upwards from its free surface level into the space above. It can only occur when the temperature of the liquid is such that the particles exert sufficient pressure to overcome the superincumbent gaseous pressure, and so pass freely from one side to the other of the surface level. For every given external pressure on unit area of the liquid, there is a corresponding temperature of ebullition or *boiling-point*. But it must be understood that a certain amount of diffusion of the water-particles may take place even when their pressure is insufficient to allow perfectly free passage from the liquid to the gaseous condition. This diffusion is called *evaporation* (q.v.); it is identical with ebullition only when the vapour pressure is equal to that special pressure of the liquid that corresponds to the given temperature. Thus evaporation of a liquid in contact only with its own vapour is really ebullition, and the vapour is then said to be at *dew-point* (q.v.), or to be *saturated*.

Écarté (French *écarter*, to discard), a game of cards originating in Paris early in the 19th century, but said to be based on an old French game, called *triomphe*. It is played by two persons with a pack from which the small cards (the two to the six inclusive of each suit) are taken. The king counts highest, the ace between the knave and the ten. The dealer gives five cards to his adversary and five to himself, turning up the eleventh as trumps, and then, if dissatisfied with his hand, may "propose" to discard (whence the name). Should the proposal be accepted, each player, without showing his cards, discards as many of them as he pleases, drawing an equal number from those yet undealt. The dealer then leads, the adversary follows, and two cards form a trick. The game is five up. The rules as to trumping, following suit, and taking tricks are like those in whist, except as to the values of the king and ace. There are standard rules approved by the Turf Club.

Ecbatana (a word which is taken to mean *treasury*) is the name of several towns of antiquity. Of these the most important is the old capital of Media, said to have been built by Seleucus. Its position is doubtful, but Deioces is said to have had here a wondrous palace surrounded by seven walls, the different battlements of which were each of a different colour. According to the biblical account it was the chief seat of Cyrus, and it appears to have been as favourite a residence of the Persian as of the Median kings. The palace existed in the time of Josephus.

Ecce Homo (Lat. Behold the Man!) a title

of pictures of Christ suggested by Pilate's saying (John xix. 5). The best known is by Correggio. Also the title of a book, attributed to Professor Seeley of Cambridge, which made considerable stir in England on its publication (1865), partly from its ability, partly from its alleged heretical tendencies.

Eccentric, in machinery, a contrivance for converting the rotating motion of a shaft into an oscillatory straight-line motion. It is in very general use for working the steam-valves of engines. It consists of a circular disc fitted on to the rotating shaft in such a way that it is perpendicular to the axis of the shaft without this axis passing through the centre of the disc. Thus its motion is ex-centric, the centre of the disc describing a small circle around the axis of the shaft. Round the edge of the disc is fitted a metal ring or strap, to which is rigidly fixed the eccentric-rod. The farther end of this rod is constrained to move in a straight line, and therefore has a backward and forward motion in that line imparted to it. The eccentric may, therefore, be regarded as a special kind of crank; the disc corresponds to the crank-pin, though considerably enlarged; the eccentric-rod corresponds to the connecting-rod, the strap to the sleeve that fits on the ordinary crank-pin.

Echymosis. If the capillaries of the skin be damaged by bruising or in certain forms of disease [PURPURA], an extravasation of blood occurs, which if limited in extent is called an echymosis (from two Greek words, *ek*, out, and *chymos*, juice). If the escape of blood be so considerable as to give rise to pronounced swelling the condition is spoken of as hæmatoma.

Ecclefechan, a town of Dumfriesshire, 20 miles N.W. of Carlisle, noted as the birthplace of Thomas Carlyle, who was also buried here by the side of his father and mother. He mentions the place, under a pseudonym, in *Sartor Resartus*.

Ecclesfield, a township in the West Riding of Yorkshire, six miles N. of Sheffield. Its chief industries are the manufacture of cutlery, linen, paper, and nails, and there are coal and iron mines in the neighbourhood. Pop. (1901), 34,153.

Ecclesia (Greek, an assembly; from *ekkallo*, to summon), the name of the citizen body in Athens and other Greek democracies summoned to transact public business. In early Christian times it was applied to the Church, the body of believers called out from the world by God. In the Romance languages the name for Church is usually derived from it.

Ecclesiastes, or THE PREACHER (*cf.* i. 1, 12) (the title is a translation of the Greek title *Kohleth*, which probably means one who calls an assembly), a poetical book of the Bible, attributed to Solomon by Jewish and ecclesiastical tradition—as well as by some modern critics. Chapter ii. and other passages, indeed, seem distinctly to assert his authorship, though some ancient Jewish critics believed that the work had been edited after the reign of Hezekiah. But it is now very generally believed to be much later than the Captivity, even

by orthodox critics (*e.g.* Delitzsch), partly on the ground of its language, which appears very late in vocabulary and grammar, and contains Aramaisms; partly from some of its alleged allusions to contemporary history (*e.g.* iv. 13, v. 8, x. 16), which are thought to point to the misrule during either the Persian or Macedonian supremacy, and partly from certain alleged affinities to Greek philosophy, Epicureanism (*e.g.* ii. 21), the doctrine of the highest good (ii. 3), and the Stoic doctrine of cyclic progress (iii.). But the significance of these allusions, especially the last-named, has been much disputed. On the strength of this internal evidence various dates have been assigned to it, ranging from shortly after the return from the Captivity to the reign of Herod the Great. There is almost as much variety in the ideas of commentators regarding its plan and scope. The author gives his own experience of life, which in a certain sense has left him a pessimist. He has found that wisdom and knowledge, luxury and power, are all alike vanity; men are subject to the inscrutable law of God, who gives to each as He wills. And the author decides for submission to the law of God (xii. 13 and iii. *passim*), the life of righteousness, and the acceptance of the calm happiness of ordinary simple human life (iii. 12, v. 18, xi. 9). Perhaps this is vindicated against the growing strictness that culminates in Pharisaism (*cf.* vii. 16). But there are sceptical and pessimistic passages, and critics have found several inconsistencies of thought. Again: while some critics have detected an elaborate arrangement of the poem in strophe and antistrophe, others have thought the work unfinished and edited after the writer's death, partly from his rough notes; and passages have, it is maintained, been modified to suit the needs of Jewish orthodoxy. There seems to be a considerable element in the book of the proverbial wisdom which is embodied in Proverbs and Ecclesiasticus. There is little doubt that the writer lived in Palestine, and was familiar with the Temple worship. Orthodox critics dispute the significance of the alleged allusions to the post-exilic period and to Greek thought, and assert that the peculiarities of the language are the effect of Solomon's intercourse with his foreign wives. The opening and closing portions especially are of great poetic beauty and dignity. The genuineness of the last chapter is much debated. The canonicity of the work was disputed between the Jewish schools of Hillel and Shammai, and was not agreed upon till after the destruction of Jerusalem. Luther wrote a commentary on it, and the works dealing with it are very numerous. Of recent commentaries those of De Ginsburg, Dr. C. H. H. Wright, Dean Plumptre, and Mr. T. Tyler may be mentioned. The latter has attempted to show the influence of Greek philosophy. M. Renan has also written a somewhat flippant and unsympathetic treatise on the book.

Ecclesiastical Commissioners are a body of persons, constituted under statutes passed during the reign of Queen Victoria for the general management and supervision of the Estates of the Church, being either episcopal or capitular, and for the proper

application of the revenues or produce thereof in support and extension of the Church.

Ecclesiastical Courts are Courts having only spiritual jurisdiction—that is, jurisdiction in ecclesiastical matters and in which the Canon Law is administered. [CANON LAW.] They are:—(1) The two principal Courts of Canterbury and York; (2) The Court of Arches; (3) The Diocesan Courts of each Diocese [ARCHES, ARCHDEACON]; also several other courts which have either become obsolete or are not strictly judicial tribunals—such as the Court of the Vicar-General and that of the Master of the Faculties. [VICAR-GENERAL, FACULTIES.] The Privy Council is the supreme Court of Appeal in Ecclesiastical matters. A large department of what was formerly ecclesiastical business—e.g. the granting of Probate of Wills and Administration—has now been swept away by the establishment of the Court of Probate. [PRIVY COUNCIL, PROBATE.] In Scotland the analogous institutions are the Kirk Sessions—Presbyteries, Synods, and General Assemblies. Dissenting bodies have both in England and Scotland courts or councils of their own.

Ecclesiasticus (Greek, the Church Book, from its frequent use in the services of the early Christian Church), the oldest of the Apocryphal books of the Old Testament [APOCRYPHA], and called by its author *The Wisdom of Jesus the son of Sirach*. From his preface we learn that it was written by one Jesus or Jeshua, in the Hebrew (probably not the Aramaic) language, and translated by his grandson, Jesus, the son of Sirach, whose name it bears, "in the thirty-eighth year of Ptolemy Evergetes." This rendering, however, is disputed. There are two kings of this name; and it mentions, also, apparently as nearly contemporary, a certain Simon the High Priest, the son of Onias, who repaired the fortifications of Jerusalem. But there are two kings and five high priests who bore the names. The Simon mentioned is identified with either the first (310-290) or the second (219-199 B.C.), and the Ptolemy Evergetes with Ptolemy Physkon, who reigned from 170 to 116 B.C. Thus the work may have been originally written either about 300 or 180 B.C. and translated at some time during the 2nd century B.C. In substance it is chiefly a collection of moral maxims, modelled on, and sometimes borrowed from, Solomon's Proverbs. In part they are grouped by subjects, but the work was perhaps composed piecemeal and exhibits no very definite scheme. It opens with a noble exordium on the supreme wisdom of God and an exhortation to patience and trust, and contains descriptions of nature, and passages of very great beauty and eloquence in praise of famous men. (See chap. xlii. 89.) At the same time, the sayings are sometimes homely, and sometimes exhibit mere self-regarding, worldly wisdom. There is little or no trace of belief in Satan, of the hope of a Messiah or a resurrection, or of the doctrine of a future life. The work is of much importance as exhibiting Judaism in a stage hardly known otherwise: slightly touched by Greek thought, but little affected by Alexandrian influences, e.g. wisdom is not personified here as in the book

bearing that name. The work is perhaps alluded to in the Epistle of St. James (i. 19; cf. Eccles. v. 13). It is often quoted in the Talmud and by Clement of Alexandria, and was held in high esteem by St. Augustine as well as by the reformers of the 16th century. At least two well-known hymns—*Jeru, the very thought of Thee*, and *Now thank we all our God*—are said to be derived from it, and it had a considerable influence on liturgical language of the early Church.

Ecgonine, a basic substance, of composition $C_9H_{15}NO_2 + OH$, which is obtained in prismatic soluble crystals by the decomposition of cocaine.

Échelon (French, the rung of a ladder), a method of forming troops, so called either from its appearance or because the different bodies concerned can support or replace each other, and so be used successively to attain their end. The line is broken into parts, which are moved forward successively, so that each part is parallel to the rest, but no two form part of the same line, and each has its front clear of all those in advance of it.

Echemin, an Algonquian nation formerly powerful in New Brunswick and Lower Canada, where their name still survives in Lake Echemin and its emissary the Echemin river, which flows to the St. Lawrence a little above Quebec. A few half-breeds crossed with early Scottish, English, and especially French settlers, are still found in the St. John river basin, where they live mostly by fishing and hunting, though some cultivate a little ground round about their log-huts. They are distinguished by their squat figures, thick lips, prominent cheek-bones, small eyes, and lank, black hair, altogether resembling the Eskimo more closely than the ordinary Algonquin type. [ALGONQUIN.] These half-blood Echemins (properly Eteminquois) suffer much from pulmonary affections; they age prematurely, and, as infant mortality is excessive, they are evidently dying out, like their Mic-Mac and Abenaki neighbours. They were evangelised two centuries ago by the French missionaries, and now pass for Roman Catholics. Their Algonquian dialect is also largely affected by French and English influences. This language has been studied by Père L. E. Demillier (*MS. Dictionary*) and by Dr. Joseph Barratt, who shows that it is the same as that of the Passamaquoddy Indians of New England. (*Key to the Indian Language*, etc., Middleton, Connecticut, 1850, and other writings.)

Echidna, a genus of primitive mammals, constituting with *Ornithorhynchus* (q.v.) the sub-class *Prototheria* (= *Monotremata* = *Ornithodelphica*). This genus, which has several species, is confined to the Australian region, and owes its scientific name (= viper) to the presence of a perforated spur on the heel, long supposed, but erroneously, to be poisonous, though its function, as well as that of the glands with which it communicates, is unknown. The best-known species, *E. hystrix*, from Australia, is about a foot long, and in appearance resembles a hedgehog with a long, naked snout, and strong feet fitted for digging. The ends of the toes of the hind

feet turn outwards and backwards when the animal is at rest. Ants are its favourite food, and these are taken with its long protrusile tongue, which is covered with a slimy secretion to which they adhere, and, after being swept into the mouth, they are crushed between the spines on the palate and tongue. Like the *Ornithorhynchus*, the *Echidna* lays true eggs, which are carried in a pouch till hatched. The Tasmanian form, which has the hair sufficiently long to cover most of the spines, is probably only a variety, though some authorities give it specific rank as *E. setosa*. New Guinea has two forms—*E. lawesi*, from the neighbourhood of Port Moresby, distinguished by its long cylindrical spines, and the bristles on the face, and *E. bruijnii*, from the north of the island, with three rows of recurved spines on the tongue, whence it is sometimes made a separate genus (*Acanthoglossus*). These animals are popularly known as Porcupine Ant-Eaters.

Echinanthus is the name of an important genus of Sea-urchins, and belongs to the family *Clypeastridae*. The best-known species is the West Indian *Echinanthus rosaceus*, Linn. (or, more strictly, *Echinanthus reticulatus*, Linn.). The members of this genus differ from *Echinanthus* in the fact that the margins are swollen and the base rounded, instead of sharp and flat respectively. The name has often been applied to a genus of fossil forms belonging to a different group.

Echinida, a family of Sea-urchins (*Echinoidea*), of which the common Sea-urchin or Sea-hedgehog (*Echinus esculentus*) is the type.

Echinococcus is a tapeworm in its encysted, or resting stage. That of the well-known species *Tenia echinococcus* of the dog had been described as a distinct genus and specimen, as *Echinococcus veterinorum*. [TAPEWORM.]

Echinocorys is the name of the genus of Sea-urchins which includes the chalk "Shepherd's Loaf." This is one of the best known of typical chalk fossils, but is usually referred to as *Anachytes oratus*. As this name, however, is of a later origin than *Echinocorys scutatus*, the latter is now adopted.

Echinodermata, one of the Phyla, or main groups of the animal kingdom. It includes the Sea-cucumbers, Sea-urchins, Starfish, Brittle-stars, Sea-lilies, and some less-known extinct classes. The name is derived from the best-known member of the group, the common Sea-urchin (*Echinus esculentus*), and means "spiny-skinned." This term is not, however, appropriate to some groups, such as the Sea-cucumbers, in which there is either no skeleton or only a few thin, scattered plates, or spicules. The one character which all the Echinodermata possess in common is a series of canals, tubes, or reservoirs that convey water throughout the body. This is known as the "water-vascular system." Its function is either respiratory (Sea-lilies), locomotive (most "regular" Sea-urchins, including the common British species), or both (as in the Heart-urchin). In addition to the water-vascular system, there is a series of vessels through which flows the blood. This is, therefore, called the blood-vascular

system. It serves to distribute the food after its digestion in the stomach. As the blood is not definitely corpusculated, the so-called "corpuscles" having very irregular forms, the blood has been called the "chylaqueous fluid." The nervous system is very primitive in character; it consists of a series of nerve cells scattered about the muscular tissue; processes from these cells may unite with one another to form a loose nerve-plexus, or cord. The nerves are usually in the superficial layers of the body. The digestive system differs from that of the *Cœlenterata* (q.v.) by being closed and completely separated from the body cavity. There is a mouth generally opening in the centre of the oral or abactinal surface. This leads by a short œsophagus to a simple but fairly capacious stomach, or "gut." The gut in the Sea-lilies and extinct blastoids and cystoids was a wide coiled tube. The intestine is short, and may open to the exterior by an anus; in many members of the group, however, there is no anus. From the stomach five pairs of pouches arise, and serve to store and digest food; these are known as hepatic cœca. The nervous, blood, and water-vascular systems of the Echinodermata are all arranged fundamentally on the same plan. Each has a ring round the œsophagus, from which five branches radiate. The animal is, therefore, composed of five similar portions, or "actinomeræ." These may be more or less completely marked off as arms, as in the Starfish, Brittle-stars, and Sea-lilies, or of five segments, as in the Sea-urchins and Sea-cucumbers. The development of the Echinodermata is marked by a remarkable metamorphosis, the details of which differ greatly in the different classes. Reference should be made to each of these. The Echinodermata are all marine, except a few forms which live in brackish water. They have a great range in space, depth, and time. Owing to the strength and importance of their skeletal structures, they are often preserved in a fossil condition, and are of great value to the geologist. The Echinodermata may be grouped into classes:—

- | | |
|---------------------|-------------------|
| I. Cystoiden. | All extinct. |
| II. Blastoiden. | All extinct. |
| III. Crinoiden. | or Sea-lilies. |
| IV. Ophiuroiden. | or Brittle-stars. |
| V. Asteroiden. | or Starfish. |
| VI. Echinoiden. | or Sea-urchins. |
| VII. Holothuroiden. | or Sea-cucumbers. |

Echinoidea, a class of Echinodermata (q.v.), including the Sea-urchins. The characters of the class are that the skeleton consists of 20 zones of plates (the number varies in some extinct genera), generally solidly united to form a spherical, heart-, or disc-shaped body. Each plate bears one or more spines. Ten of the zones are usually smaller than the others, and are perforated for the passage of the "tube feet," and for the ambulacral areas. The mouth opens on the ventral or actinal side of the body, and is typically central in position. The anus opens either at the dorsal or abactinal pole of the body or in some position in one of the inter-ambulacral areas, which is thereby marked out as the posterior. Echinoids are always free, and never have a stalk or any indication of one. The main character of the Sea-urchins is the skeleton, or test. This is

composed of five sets of plates, arranged in vertical series. In all living forms there are ten pairs of vertical series, five being ambulacral and five being of larger plates separating these. In many extinct genera the number, however, is irregular. They usually occur in ten alternating series of plates, but each series may consist of more than one pair, as in *Melonites*; the interradial series may be more than a pair in number, as in *Archæoidaris*, or they may each consist of only a single series, as in *Bothrioidaris*. The plates of the interradial series remain distinct, but those of the ambulacra may be united into compound plates, the nature of which differs in the different groups. In addition to the vertical series of plates there is usually a group of plates arranged as one ring of ten plates, or as two rings of five plates, at the upper pole of the body. In the regular Echinoids the anus opens in the middle of this group, but in the higher forms the anus has worked back till it opens in the posterior interradius, far from this "apical system" (q.v.), or even on the under-surface. In some of the most specialised Echinoids the apical system has been broken up (as in *Collyrites*), and in others it cannot be traced (*Pourtalesia*). The most important of the remaining skeletal structures are the jaws, and the "perignathic girdle" of processes around the mouth, which support these. The jaws are not found in the order *Spatangoida*. The structure of the jaws and details of the anatomy of a typical Echinoid are given under SEA-URCHIN (q.v.). The plates of the skeleton are usually ornamented by a series of small prominences or tubercles, which bear the spines. These serve for protection and locomotion, the animal often walking on the tips, as on stilts. The largest spines are called "primaries;" but there are series of much smaller ones, borne on small tubercles or granules, known as secondary tubercles or miliaries respectively. In many of the Spatangoids, or Heart-urchins, there are narrow bands of crowded minute granules, forming the fascioles. These bear small spinelets, and some of the modified spines known as pedicellariæ. These structures consist of a short flexible stem, bearing a head formed of two or three jaw-like valves. The use of these pedicellariæ is not quite decided, but they appear to act to some extent as organs of defence; while they have also been seen to pass the excreta from the central anus to the margin of the body. The Echinoidea are at present grouped into two main groups—the Paleoechinoidea and the Euechinoidea; the former, however, is a motley collection of extinct forms that must be eventually dispersed. It includes most of the Paleozoic representatives of the class. The most remarkable form included in it is the abnormal *Tiarechinus* that lived in the lagoons among the Triassic coral reefs of the Tyrol. The Euechinoidea are divided into five orders—Cidaroida, Diadematoida, Holoctypoida, Clypeastroida, and Spatangoida. The oldest known Echinoidea comes from the Ordovician rocks; the fossil forms are most abundant in the seas of the Jurassic, Cretaceous, and Cainozoic. They are of much value to the geologist, as they give so much assistance in problems of geographical distribution, as their range in depth is generally marked by definite characters. All the living

Echinoids are marine; they occur in most seas and at all depths, but abound most in the shallower parts of the tropical and subtropical regions.

Echinolampidae, a family of Sea-urchins of which the type-genus *Echinolampas* is very abundant in the Lower Cainozoic beds. The genus still survives in the West Indies, Pacific, etc.

Echinopodium, a name applied to the larvae of some of the Echinodermata, including the *Pluteus* (q.v.) and *Bipinnaria* (q.v.).

Echinopharites, an interesting genus of Cystoidea that lived in the Lower Silurian period, and had a compact globular form.

Echinothuridae, a family of Sea-urchins of which the type-genus is the chalk fossil *Echinothuria*. The best-known genera, however, are the living *Asthenosoma* and *Phormosoma*, which are mostly deep-sea dwellers. The most striking character of the family is that the tests are flexible and the plates imbricate; the spines are small and covered in membrane, and the apical system (q.v.) is rudimentary. These are all primitive characters, but the family is in all probability degenerate rather than ancestral. An "echinothroid" form is probably attained by representatives of the different orders. The genus *Pelanechinus* from the Corallian rocks is usually referred to this family.

Echinozoa, a name given to a subdivision of the phylum Echinodermata, and including the Echinoidea, Asteroidea, and Ophiuroidea (brittle-stars), and sometimes the Holothuroidea. The last is, however, often separated as a distinct group under the name Scytopodermata.

Echinus. [SEA-URCHIN.]

Echo, in *Acoustics*, is a reflection of sound. Sound is a wave-motion through some sort of medium capable of transmitting it; when the wave reaches a surface that either partially or wholly resists farther motion onwards, it is partially or wholly reflected back through the original medium. The wave of sound may affect the ear of an observer both before and after reflection, and so produce the effect of two distinct sounds. If the source of sound be close to him, the interval that elapses before the echo reaches him will represent the time taken for the wave to travel to the reflecting surface and back again. Taking the speed of sound as 1,100 feet per second, a cliff 55 feet away from the source of the wave-motion would reflect it back to the same place in $\frac{1}{10}$ th of a second, because in that time 110 feet could be traversed by the wave. Such an interval as this is just distinguishable by an ordinary ear; but for the echo to be more distinctly isolated greater distances than 55 feet are necessary. For the echo to be as loud as possible the reflecting surface must be so shaped that the wave is concentrated towards the observer; but whereas this makes the echo louder in that immediate region, it renders the sound less audible elsewhere. Cliffs that are hollowed out with deep recesses illustrate this well, as also do the "whispering galleries" in various buildings. An irregular reflecting surface may send back many reflected

waves, and so produce several echoes. This is shown by the echoes of thunder among the clouds, which cause the long-continued reverberation familiar to all. Among well-known echoes may be mentioned that of the Lorelei rock on the Rhine, which is said to repeat sounds fifteen times; that of the tomb of Metella, near Rome, which will repeat a hexameter line; and that of Simonetta, near Milan, which gives sixty definite echoes of the report of a pistol.

Ecija, called from the great heat that prevails the "Frying-pan of Andalusia," is a Spanish city in the province of Seville, situated on a tributary of the Guadalquivir, 53 miles N. of the city of Seville. It was a Roman colony, and there are some Roman remains. A fine old bridge crosses the river, and there are some old gateways in the walls, and the town has six churches and some interesting buildings. There is a good square, with porticoes round and a fountain in the middle, and there is a fine promenade along the river bank. The chief productions are woollen cloth, linen, flannel, and silks, and corn, wine, and some cotton are produced in the neighbourhood.

Eck, JOHANN MAYE VON (1486-1543), a German theologian, who took his name from his birthplace, Eck, in Swabia. He was learned in the works of the fathers, and was skilful in argument, and was a formidable opponent of Luther and Melancthon. He studied at Heidelberg and other places, and was ordained in 1508, and was appointed Professor of Theology at Ingolstadt, a post which he held till his death. He challenged Luther and Carlstadt, and in 1519 held a disputation with them at Leipzig, with Luther upon the Pope's supremacy and similar points, with Carlstadt upon grace and free-will. He made three journeys to Rome, from the first of which he brought back the bull which proclaimed Luther a heretic. He took part in several conferences, among them being the Augsburg Diet in 1530 and that of Worms in 1540. His work upon Papal Supremacy was written in 1520, and his controversial works were collected into four volumes.

Eckermann, JOHANN PETER (1792-1854), a German man of letters born in Hanover, and known chiefly as the friend and editor, and to some extent biographer, of Goethe. After a year in the army and two years in the Hanoverian war office, he became a student, and shortly afterwards published a work upon Goethe, who thereupon employed him to prepare an edition of the poet's works. In 1830 he travelled with Goethe's sons, and in 1839 brought out a complete edition of the poet's works. His *Conversations with Goethe* are highly valued, and have been widely translated.

Eckhart, MEISTER, a German mystic philosopher and divine of the 13th century. He was a Dominican, and attained a high standing in the order. In the later years of his life he preached at Strasburg, Frankfort, and Cologne, dying in 1327. His theory was that ultimate Being is without personality, but contains potentially the difference

of existence and personality; that self-conscious personality arising from absolute personality became God the Father, the self-consciousness giving rise to the Son and to the Holy Spirit, Who is the will of Father and Son. This development, however, is not successive but simultaneous and eternal. He further held that all creation contains part of the Divinity, and that the soul of man has a spark of Divine Essence, which strives to return to its original source. His views of the expurgation of the soul till it is filled with the Divinity have much that is akin to the Buddhist doctrines. In 1325 Eckhart was accused of heresy, and cited before the Archbishop of Cologne, but the charge was not made good, though after his death a papal bull declared his writings heretical. Sermons and tracts of his in Latin and German are extant.

Eclampsia, a term applied to the epileptiform seizures which occur in association with certain morbid conditions. The most common use of the word is in the expression *puerperal eclampsia*, which is applied to the epileptiform attacks which in rare instances occur during parturition. Infantile convulsions are sometimes spoken of as *infantile eclampsia*, and the terms *scarlatinal* and *uræmic eclampsia* are also employed. [CONVULSIONS.]

Eclecticism (Gk. *eklegein*, to choose out), a term applied to those systems of philosophy which are composed of doctrines borrowed directly from other systems and more or less harmonised. Such systems are not uncommon when conflicting philosophical schools with developed doctrines exist and philosophical interest and study are general, as in the present day. Usually eclecticism exists side by side with scepticism. While the sceptic rejects all systems on the ground that none is satisfactory and that they are mutually destructive, the eclectic sees truth in all and tries to select and combine it. When Greek philosophy came into Rome as part of Greek culture, it was natural that such Romans as studied it more profoundly should not take decidedly to any one school. And as the scepticism of Carneades (q.v.), with its destructive criticism, had emphasised the need of practical standards of belief and conduct, it was natural that an attempt should be made to supply them from previous thought. We find, moreover, a certain tendency to similarity and compromise in the Stoic and Epicurean as well as the Sceptic schools in the first century B.C. All this prepared the way for the Eclecticism of which Cicero may be taken as the type. While considering himself one of the New Academy, and therefore bound to maintain that final acceptance of any philosophical doctrine is impossible, he nevertheless accepts definitely the Stoic doctrines of the existence and providence of God and the equality of men as rational beings bound by a law of nature and reason; yet he is not, like the Stoics, materialist, nor does he accept all their moral doctrines. Another "eclectic," Sotion of Alexandria, the teacher of Seneca, combined Stoic and Pythagorean views. It need hardly be said that this fusion and reconciliation of views prepared the way for that far more extensive fusion which culminates in Neo-Platonism.

Eclipses, in *Astronomy*, are special phenomena which occur when the sun, earth, and moon are in a line. When the earth is between the moon and the sun, the moon lies in the shadow of the earth, and so suffers temporary obscuration; a *lunar eclipse* then takes place. When the moon passes between the earth and the sun, the latter is at certain places on the earth obscured by the dark body of the moon, and a *solar eclipse* takes place. The comparative rarity of these occurrences, and the grandeur of the effects produced, have combined to impress the ancients and uneducated people of later ages with a deep sense of their supernatural origin.

(a) *Lunar Eclipses*. The shadow cast by the earth is conical, and may be shown to extend about 1,000,000 miles from its surface. At a distance of a quarter of a million miles away the width of this shadow is about 6,000 miles; and if the moon passes into it at that approximate distance from the earth, its disc of 2,000 miles diameter may be partially or totally obscured. The moon and sun may be on opposite sides of the earth, and yet the former not in shadow. This is due to the fact that the moon's orbit round the earth is not exactly in the same plane as that of the earth's orbit round the sun. If it were so, we should have total eclipses at every full moon; but since the two planes are inclined to each other at an angle of $6^{\circ} 9'$, eclipses will occur when the moon is at or near its *nodes* or positions of coincidence with the plane of the ecliptic. Partial eclipses are produced when only a portion of the moon passes into shadow; annular eclipses such as are sometimes observed in the case of the sun cannot occur with the moon.

(b) *Solar Eclipses*. The shadow cast by the moon is also conical, and extends over a slightly varying distance of about a quarter of a million miles from the moon's surface. This being the approximate distance of the moon from the earth, it is seen that when the moon is between the earth and the sun the shadow may reach the earth. The extreme limit of the shadow may range from 23,000 miles short of the earth, in which case an entire eclipse of the sun is impossible, to 15,000 miles beyond the earth. In the latter case a circular shadow will be projected on the surface of the globe, travelling onwards slowly in the direction of the motion of the moon. Within this shadow or *umbra* the body of the sun cannot be observed, and a total eclipse prevails. A circular region exists round this shadow, in which only part of the sun is visible; this region is therefore partly in shadow, and is called the *penumbra*. Outside the penumbra the whole sun may be viewed; the moon's shadow is not nearly large enough to render a solar eclipse co-existent over all parts of the earth's face towards the sun.

When the moon's shadow falls short of the earth there still exists a shaded circular region on the globe where the black disc of the moon obscures the central portion of the sun. But the disc has not a sufficiently large angular diameter to hide the whole face, and a ring of light still remains. This is an *annular eclipse*; it takes place when the

moon is at a great distance from the earth compared with the sun's distance. It is evident that solar eclipses resemble lunar ones in occurring only when the moon lies nearly in the ecliptic. The general appearances of the sun's surroundings during an eclipse are mentioned in the article *SUN*. Four is the usual number of eclipses of sun and moon in a year; they cannot be less than two or more than seven.

Ecliptic, in *Astronomy*, is the path in the celestial sphere apparently taken by the sun during each year. It is a great circle, cutting the celestial equator at two points 180° apart, and making with it an angle of about $23\frac{1}{2}^{\circ}$. It defines the plane in which the earth is moving round the sun. The name was given to it by early astronomers, who observed that eclipses only occurred when the moon was crossing it. [ECLIPSES.]

Eclogue (Gk. *chosen out*), a short poem describing some scene or episode in pastoral life—frequently a musical contest between shepherds, or the lament of a disconsolate lover. The poems of Theocritus bear the name and are imitated by Virgil, who again has found modern followers.

Ecstasy (from a Greek word, signifying a *trance*) is a condition occasionally met with in hysterical subjects and in religious fanatics, in which the mind of the patient is a complete blank, save as regards some all-overpowering delusion. In some instances the subject of the ecstatic condition will remain for days apparently completely insensible to external impressions; in other cases the patient is noisy and excited, and the *dancing mania* of the Middle Ages represented probably a state allied to this. The treatment of ecstasy is mainly a matter of the exercise of moral influence over the patient, combined with good food and the removal of unhealthy mental surroundings. [HYSTERIA.]

Ecthyma, a term applied to certain forms of pustular eruption of the skin. The individual pustules may be as large as a split pea; after a while the contained matter escapes and scabs are formed, the healing process being sometimes very slow. The term *impetigo* is often used as synonymous with ecthyma. One variety of the affection is markedly contagious (*impetigo contagiosa*); it commonly occurs in young children. The local treatment of ecthyma is practically identical with that of eczema (q.v.); the general health is almost always at fault, and tonics and change of air are usually indicated.

Ectocyst, the name of the external layer in the wall of the Bryozoa.

Ectoderm, the external layer of the bodies of the Lower Metazoa (q.v.); it is formed from the epiblast. The more specialised covering of the Higher Metazoa is known as the epidermis.

Ectoparasite. [ENDOPARASITE.]

Ectoprocata, the group of Bryozoa (q.v.) which includes nearly all the common forms. The characters are that the anus opens outside the ring or

horseshoe-shaped series of tentacles (the lophophore), which is, moreover, placed behind the oral aperture; a large body cavity (coelome) is present. The group is divided into two divisions, the Phylactolemata (q.v.), and the Gymnolemata (q.v.).

Ectosarc, the name of the exterior zone of clear but tougher protoplasm in most Protozoa (q.v.), and typically in the *Amoeba* (q.v.). It encloses the central and more active endosarc. The ectosarc is probably formed by the dehydration (removal of water) of the originally indifferntiated protoplasm. It is also known as exoplasm.

Ectropion (from two Greek words, signifying to turn out), the condition in which the margin of the eyelid is everted, exposing the conjunctival surface. It may result from the contracting cicatricial tissue of a scar produced by a wound of the face, or may be produced by chronic inflammation of the conjunctiva. The only cure for marked ectropion is by operative treatment.

Ecuador, a South American republic, situated, as the name implies, upon the equator, having the United States of Colombia on the N., Peru on the S., Brazil on the E., and the Pacific Ocean on the W. As its limits are disputed, its precise extent is unknown; but it has 400 miles of sea-coast, and has been variously estimated to contain 127,000 and 248,000 square miles. The Andes pass through the territory with two parallel Cordilleras, between which lies a valley, 300 miles long and 40 miles wide, further divided by cross-ridges into three great river basins. This valley is at a height varying from nine to fourteen thousand feet, and of the two parallel mountain ranges the western, though of a lesser average height than the eastern, contains the highest points, Chimborazo attaining a height of nearly 21,000 feet. The conspicuous peak of Cotopaxi is not at present an active volcano, although it has broken out as late as the early part of the 19th century, and Pichincha was active four centuries ago. In all there are twenty volcanic summits. Imbabura has at times emitted much mud and water, but there seems to be some doubt whether these have not proceeded from the melting of glaciers. Cayambí is on the equator, Antisana is 1,900 feet in height, and Sangai is a restless volcano. The line of perpetual snow is here at 15,700 feet. The rivers on the E. belong to the Amazon system, and those of the W. flow to the Pacific. Those on the E. are, for the most part, torrents which cannot be navigated, and the chief of them are the Napo, Tigre, and Patasca, which flow into the Marañon. On the W. the chief are the Mira, the Esmeraldas, and the Guayaquil, the last of which has at its mouth a harbour formed by the island of Puna, which was the landing-place of Pizarro. Ecuador has every variety of climate from the *tierras calientes* in the lowlands to the *nevados* above the snow-line. Of the three basins or plateaus mentioned above that of Quito is 9,500 feet high, that of Ambato 8,500, and that of Cuenca 7,800. Quito enjoys a perpetual spring, with an abundant gentle rain, which falls at certain constant hours and renders the plateau very fertile,

but the other valleys are much less productive. There are some small lakes and hot springs. The minerals of the country are little worked, but there are gold, silver, iron, lead, tin, zinc, and copper, and some good coal, and there are quarries of marble, alabaster, gypsum, and slate. The commerce is not important, but from Guayaquil are exported cocoa, indiarubber, bark, coffee, hides, and ivory nuts, and there is some manufacture of Panama hats and other plaited articles. Some of the uplands are covered with dense forests, and the *llanos* of the lowlands are extensive. The animals of Ecuador are for the most part the same as those of the neighbouring countries, the most conspicuous of them being the condor, which inhabits the Andes. More than half of the population are aboriginal Peruvians, who form the bulk of the labouring classes. Next come the negroes, and the mixed blood of mulattoes, mestizoes, and samboes, and last in numbers, though they are the chief landholders, are the Spanish creoles. The independent republic of Ecuador dates from 1830, and is administered by a president, elected every four years, with a vice-president and five ministers, a Council, and a Congress of two Houses; the first of two Senators for each province, the second of Deputies, all elected by universal suffrage. The four largest towns are Quito, Guayaquil, Cuenca, and Loja.

Eczema, a vesicular eruption affecting the skin. It usually commences with itching, and an examination of the affected part reveals the presence of a number of minute prominences, or papules as they are called. Within each papule a small collection of fluid appears, and the papule becomes a vesicle; the vesicle then bursts, and the contained fluid exudes, and, drying on the skin surface, forms a scab. Matters are complicated, as a rule, by the scratching and rubbing of the inflamed surface, which are provoked by the intense irritation of the affected parts. Eczema may be acute or chronic. In the former case the disease runs its course in a few weeks, and may then completely disappear. Often, however, the subsidence of the acute mischief is followed after a brief interval by a fresh outbreak of the disease, which becomes chronic, and may persist even for months or years. The head and scalp (*eczema capitis*) are often the seats of eczema, particularly in children; the skin behind the ears is frequently involved (*eczema aurium*); or the cheeks may be attacked (*eczema faciei*). Other favourite situations for the disease are the flexures of the joints, the nipples, and the hands and wrists (the latter being not uncommonly affected in persons engaged in certain occupations—baker's and grocer's itch). The causes of eczema are obscure; it is said to be hereditary, and is apt to occur in those who have, or whose families have, a tendency to gout and asthma. It is also known to be dependent upon certain forms of local irritation. The disease is not contagious. The treatment of eczema may be divided into general and local treatment. Under the former head, careful dieting demands consideration. Milk, fresh fruit, and vegetables should be freely partaken of, meat must only be eaten in moderation, and alcohol

should be avoided. Pastry and rich foods of all kinds are considered harmful. The bowels must be regulated, and alkalies are often prescribed. In chronic cases small doses of the *liquor arsenicalis* are employed with benefit. As a local application in acute cases lead lotion or zinc ointment may be used; in chronic eczema preparations containing creasote or tar ointment are often applied. The affected areas must be kept clean, but soap is to be avoided; bran and oatmeal are sometimes used for cleansing purposes.

Edar, a Rajpoot state of Gujerat, tributary to the Gaikwar of Baroda, the political supremacy being vested in the presidency of Bombay. The state contains 4,966 square miles, and has a capital of the same name.

Eddystone, a cluster of rocks, some of which are partially uncovered at low water, lying about 14 miles S.W. from Plymouth breakwater, and surmounted by a lighthouse. The erection of a lighthouse on the rocks was first proposed to the Trinity House in 1691 by Mr. Walter Whitfield, and, at this gentleman's expense, one was begun from the designs of Mr. Henry Winstanley, of Littlebury, Essex. A light was exhibited from it in October, 1698, but in the following year the structure was raised by 40 feet, so as to have a total height of 120 feet. This lighthouse, which was of wood, was totally destroyed in the great storm of November 26th, 1703, its architect, who chanced to be in it at the time, perishing with it. A second lighthouse, built of wood upon a basic core of granite, was designed and completed by Mr. John Rudyerd, silk mercer, of Ludgate Hill, aided by Messrs. Norcott and Smith, shipwrights, of Woolwich dockyard. Its height to the top of the ball was 92 feet, and its greatest diameter 24 feet; and the light, which was first shown in July, 1708, was supplied by twenty-four candles, five of which weighed 2 lbs. apiece. Rudyerd's work was accidentally destroyed by fire in 1755. The construction of a third lighthouse on the rocks was, upon the recommendation of the Royal Society, entrusted to Mr. John Smeaton, who built it of dovetailed blocks of stone. It was begun on August 5th, 1756; the last stone was laid on August 24th, 1759; and the light was first exhibited on October 16th, 1759. Candles were superseded by oil-lamps and reflectors in 1810, and these by a lenticular apparatus in 1845. Smeaton's building would have remained until the present time but for the erosion of the rock on which it was planted. As it showed signs of having thus been seriously shaken, the construction of a new tower a few yards to the eastward of the old one was entrusted to Mr. Thomas Edmond and Mr. W. T. Douglass, under the superintendence of Sir James Douglass, F.R.S. The Duke of Edinburgh laid the first stone on August 19th, 1879, and the last on June 1st, 1881. The structure is of granite, 44 feet in diameter at the base, 170 feet high to the top of the lantern roof, and showing the light at a height of 133 feet above high-water mark at spring tides. The light is visible at a distance of 17 miles; and

it is supplemented with a bell weighing 2 tons for use in thick and foggy weather.

Edelweiss (*Leontopodium alpinum*), a species of the *Compositae*, related to our cud-weeds, densely covered with close, white, cottony hairs, and with radiating leafy bracts along the inconspicuous flower-heads. Growing often in inaccessible spots at a high altitude in the mountains of central Europe, it has become a trophy of the prowess of Alpine climbers.

Eden, EMILY (1797-1869), an English novelist and traveller, born at Westminster, the daughter of the first Baron Auckland. From 1835 to 1842 she was in India with her brother, who was Governor-General, and her sister, and on her return to England she published *Portraits of the People and Princes of India*. In 1866 she published *Up the Country*. Her novels are *The Semi-detached House* and *The Semi-attached Couple*, and she translated Marion de l'Orme into English blank verse.

Edenhall, in Cumberland, 4 miles N.E. of Penrith, is the ancient seat of the Musgraves, and is chiefly noted as possessing a glass goblet said to have come from the fairies, and called the Luck of Edenhall, since the well-being of the family is supposed to depend upon its safe-keeping. Uhland has commemorated it in his ballad *Das Glück von Edenhall*.

Edentata, an order of mammals confined to the Neotropical region, and having little in common except the absence of teeth, or the possession of very imperfect ones. There are five families, of which the Aardvark, the Anteater, the Armadillo, the Manis, and the Sloth (all which see) are the respective types. The extinct *Megatherium*, the type of the family *Megatheriidae*, belonged to the *Edentata*.

Edessa, the old capital of Macedonia, upon a stream 46 miles W. of Thessalonica, and at the head of a pass which commands the approach from the coast. It was the residence of the kings and their burial-place, among those buried here being Philip II. (336 B.C.), and the granddaughter—with her husband—of Alexander the Great. The old name, *Ægæ*, and the modern one of *Vodhena* are both thought to be derived from the abundant water in the neighbourhood. There is another Edessa in Mesopotamia, which came into the possession of Baldwin in the first Crusade.

Edfu, a village of Upper Egypt, on the left bank of the Nile, about 50 miles below the cataracts of Syene, in lat. 24° 58' N. It is noted for its famous temples, one founded about 200 B.C. of great extent and imposing architecture, and adorned with elaborate hieroglyphical inscriptions, and the other containing the history of the god Horus. The villagers still manufacture a kind of earthenware which closely resembles the ancient pottery.

Edgar (944-975), a king of the English, commonly known as Edgar the Peaceable, as his reign was a period of prosperous development and greatly favourable to the fusion of conflicting national

elements. He strengthened and consolidated the internal administration of the kingdom, and formed fleets for defending the coasts against Norse rovers. St. Dunstan had a great share in the government of the land. Edgar's determined administration of the laws has caused him to be charged with cruelty, and his youth seems to have been particularly open to the charge of vice.

Edgar the Atheling, a Saxon prince of the 11th century, who was a kind of Young Pretender of his day. He was the son of the exiled son of Edmund Ironside, and was born in Hungary. Edward the Confessor is supposed to have had some intention of making him his heir, but the intention was not carried out. Some partisans set him up in opposition against William, but he was soon subdued, and was, on the whole, kindly treated by the three successive Norman kings under whom he lived, though he joined in more than one revolt and fought against Henry I. at Tenchebrai. Much of his life was spent in Scotland, whose king, Malcolm, married Edgar's sister Margaret, and provided the brother with a refuge as often as he made England or Normandy too hot to hold him. Edgar had some warlike qualities, and took part in a crusade, and he defeated the usurping king Donald Bane of Scotland, and put his nephew and namesake Edgar on the throne. Little or nothing is known of his later life.

Edgehill, a height upon the borders of Warwickshire and Oxfordshire, 14 miles S.E. of Warwick. Here took place the first battle of the Civil War, on October 23, 1642. Prince Rupert neutralised the advantage which a brilliant cavalry charge had gained for the Royalists by pursuing the broken wing and leaving the rest of his army to be worsted by the unbroken wing of the Parliamentarians. Charles I. commanded on the Royalist side, and Lord Essex upon the other. In 1760 a tower was built to commemorate the battle.

Edgeworth, HENRY ESSEX (1745-1807), commonly known as the Abbé Edgeworth, was the son of a Protestant clergyman at Edgeworthstown, Ireland. The father became Catholic, and migrated with his family to Toulouse. Here the son studied, and finally entered the priesthood. In 1792 he became confessor of the Princess Elizabeth, and in 1793 to Louis XVI., in this capacity attending the king to the foot of the scaffold. After the king's death the Abbé escaped to England, and was afterwards chaplain of Louis XVIII. at Mittau, at which place he died of fever.

Edgeworth, MARIA (1767-1849), novelist and daughter of Richard Lovell Edgeworth (q.v.). She was born at Hare Hatch near Reading, but when in 1782 her father inherited the family estate of Edgeworthstown, co. Longford, Ireland, Maria accompanied him to that country. Her first work was *Castle Rackrent* (1802), a novel illustrating Irish life of the past generation. In 1803 she wrote a *Treatise on Irish Bulls*, and began that series of tales by which she is best known—*Popular Tales*, *Moral Tales*, and *Tales of Fashionable Life*. *The Parent's Assistant*, *Early Lessons*, *Harry and Lucy*, and others of the

same class are tales for children. She also wrote regular novels, *Belinda*, *Harrington*, *Leonora*, *Patronage*, *Ormond*, *The Absentee*, etc. Her father had, up to his death in 1817, a nominal share in the production of her works, but the real part he took in them was probably very little. Sir Walter Scott's *Waverley* is said to have been inspired by the idea of doing for Scotland what she had done for Ireland, and he sent her a copy of *Waverley*, without, however, avowing the authorship. In 1823 she paid him a visit, and later he visited her at Edgeworthstown. Since the first collected edition of her works in 1825, many editions have been published. Her great points as a writer are skilful plots, well-sustained interest, and a clear, nervous style.

Edgeworth, RICHARD LOVELL (1744-1817), an English author, was born at Bath. In 1752 he went to school at Warwick, and, while not neglecting intellectual work, showed much devotion to sports. In 1761 he became a student at Trinity College, Dublin, going later to Oxford, and married while still an undergraduate. He then settled at Hare Hatch, and kept terms at the Temple. He was very fond of mechanical experiments, and invented a system of telegraphy and a kind of velocipede. Having made the acquaintance of Thomas Day, he became enamoured of Rousseau's educational ideas, and later took his son to Paris to show to Rousseau as a specimen of the system of *Emile*. In 1769 he succeeded to the family estates in Ireland, but it was not till 1782 that he settled down there. He was a member of the last Irish Parliament, and voted against the Union. He made many schemes for the improvement and development of his country. Besides taking a part in his daughter's literary work, he wrote several works of his own, chiefly bearing upon the objects which he had at heart.

Edible Birds'-Nests, the name given to the nests of several species of Collocalia, or Swiftlets, a genus of Cypselidae, with ten species, ranging from Madagascar over the Oriental region, and eastward through New Guinea to the Marquesas. The scientific name of the genus (from Gk. *kolla* = glue, and *kalia* = a bird's nest) embodies the fact that these nests are of a gelatinous nature. These birds build in caves, and the nests when made into soups are highly prized by the Chinese and the peoples of the Eastern Archipelago. Jerdon (*Birds of India*) says that the nest when pure and of the first make is composed entirely of a thickened mucus secreted by the birds from their salivary glands, which are very large. It is bluntly triangular in form, small in size, and slightly concave within; of a semi-transparent, fibrous sort of texture. When these nests are taken away by the men who make a trade of collecting them, the birds make others, which are mixed with feathers and other foreign substances. Some authorities say that when the salivary glands are exhausted by repeated nest-building, the secretion becomes thin and tinged with blood, which leaves stains in the nests. Mr. Layard who visited a cave in Ceylon frequented by *C. nidifica*, the Indian Swiftlet, does not confirm this. He agrees with Dr. Jerdon

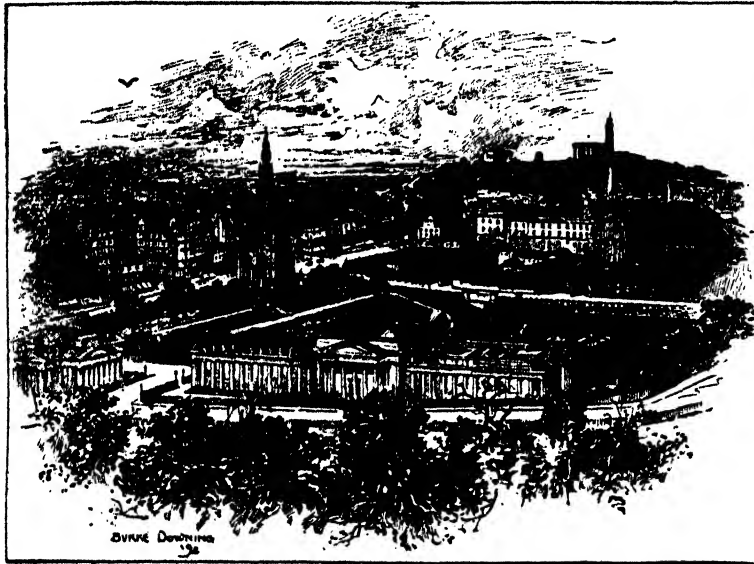
in describing the first nest as the only one which is quite white and clear, and says that it is sold for its weight in silver. The Chinese are the chief customers for these delicacies, the city of Canton alone importing some 25,000,000 annually, at a cost of about £870,000.

Edict, a law promulgated by magistrates or other competent authority; a proclamation, command, or prohibition.

Edinburgh, or **MIDLOTHIAN**, a coast county in the S.E. of Scotland, lying for a length of about 12 miles along the S. of the Firth of Forth, 35 miles

celebrated, and the chief seat of Scottish paper manufacture is along the North Esk. The county returns one member to Parliament. The principal towns are Edinburgh, Leith, Dalkeith, Musselburgh and Portobello.

2. **EDINBURGH**, the capital of Scotland, is in the county of Edinburgh, about 2 miles from the Firth of Forth, 333 from London, 42 from Glasgow, and 105 from Aberdeen. As a parliamentary borough it has four single-member divisions, and its municipal head is the Lord Provost. The town is situated upon three ridges or heights, running in an E. and W. direction, and is about 3 miles long, and the same



EDINBURGH, FROM THE CASTLE HILL. (From a photograph by A. A. Inglis, Edinburgh.)

in length, and with a breadth varying from 13 to 16 miles; containing 261,602 acres, much of which is pasture-land. In the southern part of the county are the Moorfoot and the Pentland Hills, the latter of which, starting from the neighbourhood of Peebles, run from S.W. to N.E. to the centre of the county, coming within 4 miles of Edinburgh. There are fine views from the tops of the hills. There are no great rivers, but the North and South Esk are noted for the beauty of the scenery in the neighbourhood. The only river of note is the Water of Leith. The county is upon the coal formation, and coal, limestone, and sandstone are much worked. The climate in the hills is cold and healthy, and on the coast dry, cold east winds prevail. The soil is, for the most part, a clayey loam, with some sand and gravel. The farming is good, and there is much pasture, with its accompaniment of dairy-farms, as friends of Jeanie Deans will remember. There is communication by the Forth and Clyde Canal with the Union Canal, and several railways centre here. Edinburgh also is

in width. Lofty hills surround it on all sides save the N., where it slopes gently to the Firth of Forth. The Old Town is on the central ridge, and extends from the Castle on the W. to Holyrood House on the E., which has the Calton Hill, Salisbury Crags and Arthur's Seat, for a background. To the N. and separated by a valley once occupied by a loch is the New Town. The sides of the hollow are gardens, and the valley is crossed by bridges. The houses of the New Town have a bright appearance being of white freestone, and the fine Prince Street, which is built on the N. side of the valley and has only one side, affords a fine view of the Old Town. The best view is to be obtained from Calton Hill, which gives a view of the Firth of Forth, and the hills of Fife beyond. To the S. and across another hollow, over which there are two bridges, is another comparatively new part of the town. The Old Town has a mile-long street, which rises from Holyrood House to the Castle Hill by a steep incline. The different parts of this street have been made familiar to us by Scott—th

Canongate, Netherbow, Lawnmarket, Castle Hill, etc. The houses of the Old Town are, for the most part, ancient and lofty. Among the places of interest are the Parliament House, now part of the Court of Session, the ancient Cross (restored by Mr. Gladstone), the Tron Church, and the Netherbow Port, near which is the house of John Knox. The old closes and wynds branch off laterally on each side of the main street. Of the New Town the chief streets are Princes Street, George Street, and Queen Street, all parallel. As already said, Princes Street gives a splendid view of Calton Hill, Salisbury Crags, and Arthur's Seat. A pathway winds along and up the face of the crags. The Castle contains the ancient regalia of Scotland, and here is Mons Meg, a piece of ordnance said to have been cast in 1486. Holyrood House dates partly from James V., but most of the building is of the time of Charles II. Queen Mary's rooms remain much as she left them. There are still remains of a chapel of Holyrood Abbey, and till lately its sanctuary for insolvent debtors extended for a considerable distance around. The church of St. Giles is ancient, and has an imposing appearance. By the Parliament House is the Advocates' Library, which has the privilege of being entitled to a copy of every book published in Great Britain. There are also a National Gallery, a National Portrait Gallery, a Royal Institution, the University, the Royal Observatory, the Medical School Buildings, McEwan Hall, and the Royal Infirmary. The imposing monument erected to Scott is in Princes Street, and there is a monument to Burns, besides many other statues and memorials. Among charitable institutions are Heriot's and other hospitals. Among schools, the Edinburgh Academy, the High School, and Fettes College are noted. The University, which was founded by James VI. in 1582, has all the privileges of the elder universities. The corporation consists of a chancellor (elected for life), rector (elected for three years), professors, graduates, and matriculated students. Beside the ordinary four faculties, there are also degrees in science. The University possesses good buildings and appliances for study, including dissecting-rooms, botanic garden, museum, and an extensive library. The University unites with that of St. Andrews to return one member to Parliament. Edinburgh did not become the royal residence and capital till 1437, although a parliament had been held there as early as 1215. In 1296 Edward I. took the Castle, in 1650 it yielded to Cromwell, and in 1689 to William III. In 1745 Prince Charles Edward was received. Leith is the port, and almost a suburb of Edinburgh. Pop. (1911), 316,479.

Edinburgh Review, THE, was started in 1802 by a coterie of literary men in Edinburgh, of whom Jeffrey (afterwards Lord Jeffrey), Sydney Smith, and Brougham were the chief. Jeffrey was the first regular editor. The first number appeared on October 10, 1802. Its success was immediate; in the next year its sale was 2,500 copies, in 1814 13,000. Scott and Wilson ("Christopher North") were among its early contributors, but were scared away by its growing Whiggism. Its attacks on the

Lake Poets (especially Wordsworth's *Excursion*) and Byron are well known. The latter produced *English Bards and Scotch Reviewers*. Later, Macaulay was a prominent contributor. Its success caused the starting of the *Quarterly Review* in 1808, the *Westminster Review* in 1829, and a number of other quarterlies on the same model. Long the organ of Liberalism, it is now considered as "Whiggish" and reactionary by the bulk of the Liberal party. Constable of Edinburgh was the first publisher, but it has long been published in London.

Edison, THOMAS ALVA, an American inventor and electrician, born in Ohio in 1847. He became a railway newsboy in 1859, and soon obtained the exclusive right of selling papers on his line. His next step was to print a paper on the train while travelling. Shortly after he was able to learn the telegraph, and from that time devoted himself to electricity. He has invented an automatic repeater, a system of duplex telegraphy, the printing telegraph. In the field of telegraphy he has taken out very many patents, and has made many inventions in the megaphone, the phonograph, a telephone, the kinetoscope, and in the management of the electric light.

Edmonton. 1. A town of Middlesex 10 miles N.E. of the City, and forming a suburb. It is mentioned by Cowper in his history of John Gilpin's ride, and Charles Lamb lived for some time and was buried here. There is a considerable trade in timber carried on by means of the river Lea. 2. A town in the North-West territory of Canada upon the Saskatchewan river. Lignite coal here comes to the surface.

Edmund, the name of several Saxon kings, of whom one of the most famous was Edmund Ironside, born 989, the son of Ethelred II. In 1016 he succeeded his father, and for some time contended successfully with Canute. As a consequence of a defeat which he received at Assendun in Essex he came to a compromise with Canute, who received the northern and midland counties, while Edmund retained the southern. Edmund is said to have been assassinated at Oxford by an agent of Edric of Mercia, whose desertion had led to the defeat at Assendun. Canute thus became king of England.

Edmund, St., was king of the East Angles in the middle of the 10th century. After many years of peaceful prosperity he was in 870 involved in a war with the Danes, who defeated him and made him prisoner. Upon his refusal to accept their terms of peace they beheaded him. Around his burial place a monastery and town grew up which still retains the name of Bury St. Edmunds.

Edmund, St., surnamed Rich (1170-1240), a noted Archbishop of Canterbury. His mother Mabel was very ascetic, and from her he imbibed a strong taste for an ascetic and mystic life. He was born at Abingdon. Many stories are told of his enthusiastically religious character; for instance, that he solemnly betrothed himself to our Lady by putting

a ring upon the finger of her statue, and that his asceticism was so great that he seldom went to bed. After studying in Paris he lectured in Oxford in Logic and Philosophy, and then turning to theology he paid a second visit to Paris. He gained as great a reputation as preacher as he already possessed as lecturer. It was against his desire that in 1234 he became Archbishop of Canterbury, and in the quarrels that took place between the king and the nobles he acted as mediator, not hesitating, however, to keep the king up to the mark in fulfilling the promises he had made in confirmation of the Charter. St. Edmund boldly withstood the Papal claims where he considered them to override national rights; but the Pope was too strong for him, and he finally took refuge at Pontigny and at Poissy, where he died. His winning manners and pure, upright life caused him to be admired by his contemporaries.

Edom, a hilly country to the south of Palestine, extending for 100 miles from the Red Sea to the Gulf of Akabar. The mountains are bare, and consist of chalk and porphyry, but in parts the country is tilled and produces wine. In Biblical history it was inhabited by the descendants of Esau, and the enmity of the sons of Esau to those of Jacob was constantly breaking out with varying result. Later, as Idumea, the country gave birth to the Herod dynasty. Maan, the ancient Maon, is a halting-place for the Mecca pilgrims. Mount Hor is 4,320 feet high.

Edriophthalmata, a name once used for a subdivision of the Malacostraca (q.v.), to include all the Crustaceans in that group having sessile (or non-stalked) eyes. The Isopods and Amphipods were the principal orders belonging to it.

Edrisi (1100-1180), a great Moorish geographer, who traced his descent from Mahomet. He is thought to have studied at Cordova, and travelled in Spain, Barbary, and Asia Minor, and visited the court of Roger II., king of Sicily, who employed him in geography and on a description of the earth from the reports and statistics of many travellers who were sent out to make observations. This book was completed in 1154, and has been partially and often inaccurately translated. Edrisi made a map and a celestial sphere. He also wrote upon herbs, and another work upon geography, which has disappeared.

Education, NATIONAL. The supreme national importance of training all the faculties of all the members of the State is a conception only now coming to realisation, under the stress of foreign competition in all departments of life; a natural result of the spread of knowledge, and of the improvement of intercommunication. Yet there are few periods in the history of the country when education was not carefully fostered by a class, if not by the governing authorities. The contact between Education and the State was established by the Church; and, after all deductions, the debt of education to the Church is altogether incalculable. Augustine, the first Archbishop of Canterbury (596), and the Archbishop Theodore and the Abbot

Adrian (668) spread the means and methods of education, and turned the larger and better monasteries into schools of learning, which furnished teachers to the Empire of Charlemagne. When domestic troubles and the Danish invasions almost crushed out this movement, King Alfred initiated a really national policy of education for free men—the serfs had to wait outside for four centuries more—and that education he based on English. The Norman conquest gave the predominance to Anglo-Norman and threw national education into the hands of Norman ecclesiastics, securing the monopoly of education for the Church. Until the Lollard movement, which flung the first challenge to the Church, all schools were either Church schools or schools licensed by the Church; and popular education was very general. The Black Death swept foreign priests out of the country, leaving in the churches and schools English priests in full sympathy with the people; and in 1406, in spite of the claims of lords and masters, Richard II. passed “the first Statute of Education,” which enacted that “every man or woman, whatever their state or condition be, shall be free to put their son or daughter to take learning at any school that pleases them within the realm.”

The schools at Oxford and Cambridge had been famous long before they were dignified with the title of Universities. The students lived in private houses, or clubbed together in inns or halls; the collegiate system dates from the 13th century. The Universities were much favoured by the kings. In the 14th and 15th centuries they received from Italy an intellectual impulse that laid the foundations of English scholarship. About the beginning of the 15th century there was a general and keen desire for education: the State fostered it as a spiritual and desirable object; the Church fostered it as a means of withdrawing offenders (through the Benefit of Clergy) from the secular arm; and the Lollards fostered it for the emancipation of the human mind from priestly domination. The destruction of the mediæval grammar schools under Henry VIII. was a serious blow; the erection of new grammar schools under Edward VI. was counterbalanced by the wrecking policy of his ministers; but a substantial reform was made under Elizabeth, though sadly marred by the appeal to the Court of Chancery and the House of Lords. The Revolution of 1688 secured the Protestantism of the Universities, but it was not till 1871 that they were freed from religious tests.

During the 18th century education lay fallow. By the end of the century the Church, for the first time in the history of English education, had ceased to care for the instruction of the people; and Lord Kenyon, Chief Justice, publicly remarked (1795) on the “lamentable condition” of most of the grammar schools. The blame is to be distributed between “the exclusive policy of the Church of England, the political unwisdom of the Crown, the inaccessibility and blindness of the Chancery tribunals, the reaction of the Restoration,” and “the manners of England in the century between the return of Charles II. and the accession of George III.,” the last cause being the chief. Yet this century proved the seed-time of the next.

The new educational life, fed indeed by the old endowments and by a certain amount of rate-aid and statute-aid, took its main impulse from voluntary effort, in spite of the Acts of 1662 and 1779, tempered as they were by many sympathetic churchmen. The Welsh schools due to Thomas Gouge (1609-81) had probably given a lead to the Society for Promoting Christian Knowledge (1698), whose charity schools in London were regarded by Addison (1713) as "the glory of the age we live in." In 1730 Gouge's work was resumed successfully by Griffith Jones (1683-1761), assisted by the S.P.C.K. But both movements fell away in the deadness of the latter part of the 18th century. Meantime an important part was played by the Sunday Schools (1763 onwards), which gave secular as well as religious instruction. The real popularisers, however, of a new system of elementary education were Bell and Lancaster. Bell, a clergyman of the Established Church, had started in Madras (1789) "the Madras method" of the mutual instruction of pupils, and this he introduced (1798) in London and elsewhere. Lancaster opened a school in the Borough Road (1801), fees optional, and had been driven by lack of funds to adopt the "monitorial" system, not without some knowledge of Bell's method. He soon (1805) obtained the patronage of George III., who expressed the wish that "every poor child in my dominions should be taught the Bible." In 1808 the Royal Lancasterian Institution was founded, its title being afterwards (1814) changed to "The British and Foreign School Society." Lancaster wished all children to have Christian but not denominational teaching; Bell wished all poor schools to be under the direct control of the Established Church. Their principles divided society. The Church supported Bell, forming (1811) "The National Society for promoting the Education of the Poor in the Principles of the Established Church throughout England and Wales"—an offshoot, it is said, of the S.P.C.K.—which was incorporated by Royal Charter in 1817. The raging conflict of the two parties had already drawn the attention of Parliament.

In Scotland a Compulsory Education Act had been passed in 1496. In England the first Compulsory Education Act was passed in 1802, and then under the curious guise of "An Act for the Preservation of the Health and Morals of Apprentices and others employed in Cotton and other Mills, and Cotton and other Factories" (42 Geo. III., c. 73). The menace of Napoleon had pointed to the frightful sapping of the energies of the people in their youth under the shocking economic conditions of the manufacturing districts. The Act, being in great measure due to the religious agencies, contained careful provisions for religious instruction for all denominations. It was the first legislative recognition of State-aided Education. It failed. Mr. Whitbread's Parochial School Bill (1807) at first took the form of a general Poor Law Reform Bill, but was presently shaped as a plan for the education of children whose parents could not afford to pay fees—supplementary to, not superseding, the parish schools. The compulsory clause was lost in the Commons, and the Bill was thrown out on the

second reading in the Lords. In 1816 a Select Parliamentary Committee, to inquire into the education of the lower orders, was appointed. The anxiety of the poor for education was found to be increasing and general. The schools were bad, but the Church was awaking to its duty; and the Committee suggested the principle of the later "conscience clause," to meet the scruples of the Dissenters. The master's salary "ought certainly not to exceed £24 a year." The Committee also "recommended, for a certain class of districts, schools that were practically rate-supported free parochial schools—the principle which was carried out by legislation beginning in 1870—and, for other and less helpless districts, grants for building schools—the principle carried out by the grants that Parliament began to make in 1833." The rate control was to be parochial; the inspection, diocesan (with full respect for conscience). On the Reports of the Committee, Brougham based his Education Bill of 1820. It aimed at four objects: (1) to plant a school wherever needed, the building being provided by the manufacturers, and the master's salary by a tax on the country gentry; (2) to secure efficient masters—members of the Church of England, age 24 to 40; (3) to define the character of the education—the parson to "fix the course of teaching according to the state of the parish," with a provision foreshadowing the Cowper-Temple clause of 1870; and (4) to utilise in some degree the old endowments. The Bill was withdrawn in consequence of the alarm caused among Roman Catholics and Dissenters.

For a decade there was no further attempt at legislation. But Brougham led and stimulated the public interest by his pamphlet of *Observations on the Education of the People*, by helping Dr. Birkbeck to start the Mechanics' Institutes, and by forming the Society for the Diffusion of Useful Knowledge—all in 1825. "The philosophic thought of men like Blackstone, Adam Smith, and Bentham, the organising genius of men like Lancaster and Bell, the parliamentary vigour of men like Whitbread and Brougham, and in a lesser degree Roebuck, the revival of clerical enthusiasm for the instruction of youth, the renewed usefulness of the grammar schools, had combined to create throughout the country a desire for education, which neither the indifference of the High Church Tory nor the suspicions of the Protestant Dissenter and the Roman Catholic could kill." In 1833 things began to move forward. Petitions flooded the Commons. Roebuck submitted a motion in favour of a scheme of compulsory national education—infants' schools, schools of industry, and normal (training) schools—under control of a Cabinet Minister, on lines precisely similar to the Act of 1870. The debate proved very influential. Six weeks later (Aug. 17, 1833) the House of Commons, after a warm discussion, voted £20,000 "in aid of private subscriptions for the erection of school houses for the education of the children of the poorer classes in Great Britain"—the first Parliamentary grant for British elementary education. (Up to this point, see especially De Montmorency's *State Intervention in English Education*, 1902. Cambridge University Press.)

The grant was to be divided equally between the National Society and the British and Foreign Schools Society, but later it came to be divided in proportion to the voluntary subscriptions to them; and, the National Society being the richer, the Church schools took the larger share. In 1839, however, the Government withdrew from an invidious position; it gave the administration of the grant to a Committee of the Privy Council, increasing the sum to £30,000, still for school buildings. In 1843 the grant was raised to £40,000, and applied to teachers' houses as well as school houses, and to school apparatus. The attendance, however, was poor, and the education inefficient. In 1846 Sir James Kay-Shuttleworth framed the famous Minutes from which the present system has developed. The proposals were to substitute for the monitorial system the apprenticeship of elder scholars as "pupil teachers"; to provide "Queen's Scholarships" to take such pupil teachers as passed an examination at the end of their apprenticeship to normal colleges; to make "augmentation grants" to head teachers on reasonable conditions; to extend the system of inspection (hitherto chiefly optional on the part of the managers), and to make the grants to teachers depend upon the results; and to give substantial aid to the training colleges. Still the attendance was miserably low. A Bill placing urban education under the town councils (1853) was introduced only to be withdrawn. But the Council made a limited capitation grant (in rural districts) to managers provided that the scholars made 192 attendances yearly, that the teacher held a Government certificate, and that three-fourths of the scholars attended H.M. Inspector's examination. In 1856 this grant was extended to the whole country, and the first Vice-President of the Council was appointed. The Newcastle Commission of 1858 made a comprehensive inquiry, which showed that only one child in eight was in any school of whatever kind, and that only one in four of these school children was efficiently educated. The Report (1861) recommended *inter alia*: (1) that grants should be expressly apportioned upon the examination of *individual* children; (2) that means should be taken for *reaching more rapidly* places not hitherto State-aided; and (3) that the administration should be simplified by withdrawal of the Government from *direct* financial interference between managers and teachers.

The various Minutes of the Committee of Council were digested into "the Code of 1860," and in 1861 "the Revised Code" was applied by Mr. Lowe (afterwards Lord Sherbrooke) to meet the recommendations of the Commission. The grants were now extended to educational proficiency, on the principle of payment by results. Education was to remain denominational, and to be confined to the children of the labouring class; the grants were to be given in aid of local subscriptions, were to be paid to the managers (not to teachers), and were to depend on the children's average attendance and their passing an examination in reading, writing, and arithmetic, failure in each subject involving the loss of one-third of the grant; and the subjects were ranged in six standards or degrees of advancement. The grant

had amounted to £160,000 in 1853; in 1859 it was £836,920. "If this new system be costly," said Mr. Lowe, "it shall be efficient; and if it be inefficient, it shall be cheap"—a very short-sighted epigram. Teachers restricted their energies to "the paying subjects." "The fault of the teaching in our popular schools," complained Matthew Arnold, "is that it is so little formative; it does little to touch their nature for good, and to mould them." Some relief was introduced by the Minute of February 20, 1867, which offered an additional grant on the passes in the elementary subjects, if one or more "specific subjects" were taught within the time-table.

Mr. Forster's Act of 1870 made a great advance. It created School Boards to supply the deficiency of voluntary school accommodation, and empowered them to levy rates for the building, equipment, and maintenance of schools, and to compel attendance by local by-laws; the accommodation to be calculated on the basis of one-sixth of the population. The teachers were to be certificated. The managers might teach religion and use religious exercises, but no catechism or distinctive religious formula; and all schools were put under a conscience clause. The education was no longer to be confined to the labouring class, and the limit of age was 13 (subsequently raised to 14, and to 15). The New Code of 1876 retained the principle of payment by results, but liberalised subjects and grants. Certain subjects were compulsory, others optional but encouraged. The schedule of "specific subjects" included geography, history, grammar, algebra, geometry, natural philosophy, physical geography, the natural sciences, political economy, and languages.

Mr. Mundella's Code of 1882 remedied some pressing difficulties. Individual examination was retained to secure thoroughness in the elementary subjects, but liberal grants were made for success in the higher subjects, and a "merit grant" enabled the inspectors to take into consideration the special conditions of the school. Educational and political discontent led to the appointment of the Royal Commission of 1886, which issued a most valuable Report (6 vols.) in 1888. The Commission recommended the institution of Day Training Colleges; increase of staff; partial recruitment of the inspectorate from the teaching body; revision of the standards so as to give freedom to classify pupils according to abilities and attainments; elementary instruction in science; and relaxation of the rigidity of the system of payment by results—"especially such changes as will simplify the method of estimating school work, and encourage greater variety, freedom, and breadth both in the aims and in the methods of good teachers." The Code of 1890 was framed to carry into execution the recommendations of the Commission.

The most important modification of the Code was effected by Mr. Acland in 1895. Meantime the Technical Instruction Acts of 1889 and 1890 influenced the elementary schools, if indirectly, yet considerably. An Act of 1891 gave every parent the right to free education of his children; the free schools receiving, instead of the fees, a "fee grant" of ten shillings a pupil yearly. An Act of 1893 raised the age for exemption from school

attendance under local by-laws from 10 to 11; and Mr. Robson's Act of 1899 raised it to 12. Blind and deaf children were provided for in 1893; and defective and epileptic children in 1899. Mr. Acland's Code of 1895 introduced intermittent inspection in the place of the annual examination; the change, though intended to be gradual, is already (1909) universal. In 1897 additional grants to School Boards were graduated on a sliding scale dependent on the School Board Rate, and a special Aid Grant of five shillings a child was awarded to Voluntary Schools as such, while some increase was made in the grants to "necessitous School Boards" (in districts of comparatively low ratable value). In 1898 a comprehensive system of superannuation for elementary teachers was passed, and an Act of 1899 established "a Board of Education for England and Wales" in place of the Education Department (including the Department of Science and Art), with the view also of taking over the educational functions of the Charity Commissioners and the Board of Agriculture, and of inspecting secondary schools in England (not in Wales, which was under a special Board, by an Act of 1889). It also provided for the formation of a Consultative Committee of eminent educationists, two-thirds of them "qualified to represent the views of the Universities and other bodies interested in education," to frame a Register of Teachers (established March 6, 1902), and to advise the Board generally. In the period 1890-1900 the policy of freedom for managers and teachers from the rigidity of rules as to inspection and assessment of grant made rapid progress. The Code of 1900 introduced the Block (single inclusive) grant, breaking up the threefold curriculum (obligatory, class, and specific subjects), and thus involving abandonment of the classification by standards and of the distinctive position of the Three R's; and added a Minute on Higher Elementary Schools, which, from being supplementary, has become incorporated in the Code. The changes of 1882, 1890, 1895, and 1900 worked the gradual abolition of the Code of 1861.

In 1901 the rejection of the London School Board's appeal against the judicial decision in favour of surcharges made by Mr. Cockerton, a Local Government Board Auditor, in respect of school rate expenditure for science and art teaching seriously interfered with the "Higher Grade" teaching, and with the Evening Continuation Schools. But it chimed in with the policy of the Board of Education to limit public elementary education to the age of 15. An Act of 1901 was passed to tide over the difficulty, allowing the School Boards to go on as before, provided the special expense to the school rate were sanctioned by the County or Borough Council—a foreshadowing of the Act of 1902.

The Act of 1902 aimed at unification and co-ordination. It excluded London. It abolishes School Boards and School Attendance Committees, and constitutes the council of every county and of every county borough "the local education authority," except that the councils of boroughs with a population of over 10,000, and of urban districts of over 20,000, are the authorities for

elementary education therein. It deals with higher education, which is "education other than elementary," and with elementary education, which is education in a public elementary school under 15 in the Code subjects. Higher education is limited by a rate of 2d. in the £, "or such higher rate as the county council, with the consent of the Local Government Board, may fix"; but county borough councils are unlimited, and the county rate of 2d. may be supplemented in non-county boroughs and urban districts by an additional 1d. rate. There is a conscience clause for secondary as well as for elementary schools. In elementary schools the authority is vested with control of the secular instruction, but this does not include the appointment of teachers in non-provided (*i.e.* voluntary) schools. The authority must appoint managers of provided (*i.e.* Board) schools in counties, and may do so in boroughs and urban districts; but they appoint only two out of six in non-provided schools—a provision (in connection with the general education rate) that aroused special antipathy among Nonconformists. Most cases of difference between authority and managers are to be decided by the Board of Education. Every council (with certain exceptions) must appoint one or more education committees (according to a scheme made by the council and approved by the Board of Education) to advise the council. General compulsory rates are authorised for the carrying on of all elementary schools, though the non-provided schools will practically remain under denominational control—a point that causes much heartburning.

In 1903 an Act was passed which practically applied the same principles to London. Considerable resistance, meanwhile, had been shown throughout the country to the Act of 1902, a number of persons refusing to pay that portion of the rate which was levied for education. In 1906 a further Bill was introduced under a Liberal Government, which after considerable opposition from Churchmen was withdrawn.

Edward. The principal Saxon bearers of the name are Edward the Elder, son of Alfred the Great, Edward the Martyr, slain by his step-mother Elfrida, and EDWARD THE CONFESSOR, who reigned 1041-1066. He was the brother of Edmund Ironside (*q.v.*), and was brought up in exile in Normandy. His marriage with Earl Godwin's daughter made him the slave of a powerful servant. Jealousy of the Godwins and a knowledge of the weakness of Edgar Atheling led him to coquette with the idea of making William of Normandy his heir. His alleged sanctity of life made him a favourite of the Church, and his good administration of justice endeared him to the people.

Edward I. (1239-1307). Edward I. was trained in a school of adversity, and profited by its lessons, both to avoid the weaknesses of his father and to keep the power in his own hands. After crushing the Barons at Evesham in 1265, he had the wisdom to turn their energies into a safe channel by engaging in a crusade. Still following out his idea of finding an outlet for superfluous energies, he set about the subjugation of Llewellyn and his

country, giving the country a new prince in the person of his unfortunate son. He then made an expedition against France, and next turned his attention to making Scotland a subject state, capturing its king, Balliol, in 1296. Then after a skirmish with his clergy, he made a new expedition into France, and married his second wife. Scotland became again the object of his energies, and he found a worthy foe in Sir William Wallace, for whose treatment when captured Edward has been much blamed. In 1306 a new Scottish danger rose in the person of Robert Bruce, and the fiery old king set out once more upon the familiar war-path, but death overcame him at Burgh-on-Sands. His vigorous rule, his wise policy, his encouragement of commerce, and his codification of laws have long kept his memory green.

Edward II. (1284-1327). This king's greatest misfortune was to be the son of his father, and so to provoke a comparison which was not in his favour. His unfortunate expedition to Scotland which ended in the defeat at Bannockburn did not add to his popularity, and no doubt it was a real feeling on the part of the nation that made it easy for Isabella to compass his deposition, though the country had not so strong motives as she had for his death, and was to some extent shocked by its occurrence.

Edward III. (1313-1377). Like his grandfather, Edward III. passed a stormy youth amid the distraction of family quarrels and national turmoil. The first part of his reign was occupied by the question of Scotland. Here a kind of see-saw was going on between Edward Balliol and David Bruce, but Edward made a temporary balance by defeating the regent Douglas, at Halidon Hill, in 1333. But Edward now entered upon the great scheme of his life—the obtaining of the French crown, a project which has had a lasting influence upon national history. Edward and his son, the Black Prince, prosecuted the war in France—winning first the battle of Crecy, and then the battle of Poitiers, where a king of France was captured, after the interlude of the siege of Calais. Edward's later days were dark. His warrior son dead, his French conquests passing away, and the thought of leaving the crown to a grandson ill-fitted to cope with ambitious and powerful nobles, and his own great faculties failing, seemed but a poor outcome of a glorious reign.

Edward IV. (1441-1483) belonged to the York branch of Edward III.'s descendants. After the battles of Mortimer's Cross and Towton, by which he secured the kingdom, and his marriage with Lady Elizabeth Woodville, his next step to secure himself thoroughly was to get rid of Warwick, whose position as his father's old friend and the most powerful noble of England made him a thorn in the king's side. The murder of Prince Edward, son of Henry VI., after the battle of Tewkesbury, has been regarded as a stain on the king's character. Edward's chief enemy in life seems to have been his own vigorous physical nature and his love of luxury. Edward IV. tried to keep up the traditional policy towards France, and attempted to intrigue

there, but the astute king, Louis XI., was a match for many Edwards.

Edward V. (d. 1465), son of Edward IV., was king only in name. The kind attention of his uncle, the Duke of Gloucester—afterwards Richard III.—saved him from all the troubles that attend the wearing of a crown. There seems little ground for doubting the story of the murder of Edward and his brother in the Tower of London.

Edward VI. (1537-1553), son of Henry VIII. and Jane Seymour, had a short and, in some respects, unhappy life. He died before attaining his majority, and was only ten when he succeeded to the crown. He was carefully educated, and had much intelligence, and took great interest in his books, but, though he is represented as playing a great part in the Reformation and other public questions, he was more or less a puppet in the hands of his guardians. Thus it was that he was compelled to sign the warrant for the execution of his early guardian, the Duke of Somerset, and was induced by Dudley, Duke of Northumberland, to appoint Lady Jane Grey his heir.

Edward VII. (b. 1841), son of Queen Victoria and Prince Albert of Saxe-Coburg-Gotha, ascended the throne in 1901. He was married in 1863 to Alexandra, daughter of King Christian of Denmark. As Prince of Wales (a title which he held for nearly 60 years) he was very popular. His coronation was fixed for June, 1902, but immediately before the date arranged, the King had to undergo a serious operation, and the ceremony did not take place until August in the same year.

Edwards, HERBERT BENJAMIN, SIR (1819-1868), an English soldier and Indian Civil servant, was born in Shropshire. He went to India as a cadet in 1840, and, studying the native tongues, qualified as an interpreter. He attracted the notice of Henry Lawrence and of Sir Hugh Gough, on whose staff he was at the battles of Moodkee and Sobraon. He was with Sir Henry Lawrence in his residency at Lahore, and when during Sir Henry's absence in England things went wrong, Edwards displayed much judgment and energy. His diplomacy was also used to good purpose during the Indian Mutiny.

Edwards, BRYAN (1743-1800), the historian of the West Indies, born at Westbury. He went young to Jamaica. Returning to England, he entered Parliament in 1796. His *Civil and Commercial History of the British Colonies in the West Indies* was published in 1793, and in 1796 a work upon the dealing of the Jamaica authorities with the Maroon negroes.

Edwards, JONATHAN (1703-1758), an American theologian and metaphysician, born at East Windsor in Connecticut. In 1727 he became minister at Northampton, where he officiated for twenty-three years, and then became a missionary to the Indians for six years. In 1757 he became President of Princetown College, New Jersey. His chief works are *Freedom of the Will* and *Original Sin*.

Edwin, son of Ella, king of Northumbria in the 6th century, was a child when his father died; and, the crown having been seized by an usurper, he was sent to the court of Redward of East Anglia, who put him upon the Northumbrian throne in 617. His wife was Æthelburga, daughter of Æthelbert of Kent, and through her influence and that of her chaplain, Paulinus, he became a Christian with his people, and built a church at York. He was killed in 633 in a battle with the Mercians under Penda.

Eeg (i.e. "Freeborn") the name taken by all Turkomans who can claim pure Tûrki descent as opposed to the *Kaul* (base-born, slave), that is, the issue of a Turkoman and Persian woman, and the *Dogmah*, that is, the issue of a Kaul and a Persian slave. "To a stranger these distinctions might remain unknown, unless he guessed from the beard or the handsome features of a man that he had not the honour to be altogether derived from a beardless and a noseless race" (Captain H. Collett, *The Khanate of Khiva*, p. 54).

Eel, a book-name for any fish of the Physostomous family Murænidæ, dating from the Chalk, and containing 26 genera with 230 species, widely distributed in temperate and tropical rivers and seas, some being deep-sea forms, and all frequenting the bottom. The body is much elongated, and naked or covered with rudimentary scales. There are no ventral fins, and when vertical fins are present they are continued above and below, or the continuity is broken only by the tip of the tail. The teeth are well developed, and all the species prey on other fish. [CONGER, ELECTRICAL FISHES, MURÆNA.] The name, however, is principally used for the genus *Anguilla*, of which two species (*A. anguilla*, the Common, and *A. latirostris*, the Broad-nosed Eel, Grig, or Glut) are British. In this genus, which has about 25 species, from temperate and tropical rivers and coasts, minute scales are embedded in the skin, the teeth are small, and the unpaired fin is continuous. The mode of reproduction is unknown, and microscopic examination is necessary to distinguish the sexes of individuals taken from fresh water. They spawn in brackish water, or in the sea, for during the summer shoals of young eels are met with ascending rivers, passing over floodgates, and sometimes making their way across marshy ground or wet grass. Old fish, also, often leave the water by night in search of food, and they pass the winter in a torpid condition in mud. They feed principally by night on aquatic animals, spawn, and carrion. The Common Eel, the best-known species, is about 3 feet long, greenish-brown above, and whitish on the belly. It is valued as a food-fish, and on many rivers eel-fishing is an important industry.

Eel Pout, a local English name for the Burbot (q.v.). In Scotland it is applied to the Viviparous Blenny. [BLENNY.]

Effervescence means the escape of gas in bubbles from a mass of liquid in which it has been compelled to remain by pressure. Effervescence will take place when the pressure is removed, as

when the cork is removed from a bottle of soda-water. The same discharge of bubbles may occur when, by reason of some change in the liquid, it is unable to retain the gas. Thus ordinary water effervesces a little when heated, because hot water does not hold air so readily as cold. The action is more vigorous in the case of ammoniated water.

Efflorescence. Many hydrated substances on exposure to air lose some or all of the contained water with the formation, on their surface, of a powdery deposit. This phenomena is known as efflorescence, and a familiar example is met with in the case of ordinary soda crystals, $\text{Na}_2\text{CO}_3 \times 10 \text{ OH}_2$, but if exposed to air loses one half of its water of crystallisation. The formation of nitre and sodium carbonates upon the soil in certain localities is also a case of efflorescence.

Effluxion of Time, a phrase used in leases and conveyances indicating the conclusion or expiration of an agreed term of years specified in the deed or writing, which arises from the natural course of events, in contradistinction to the determination of the term by the act of the parties, or by the occurrence of some event upon which it is determinable under the deed.

Effusion means the passage of gases from one side of a porous partition to the other, where the pressure is diminished to zero. The apertures in the partition must be very minute. The speed of flow is proportional to the square root of the pressure applied to the gas.

Efik, a negro people of the Slave Coast, dominant in the Oyono (Old Calabar) river basin, where they form a separate group, with three branches—*Efiks* proper, *Qua* on the W. side of the Old Calabar estuary, and *Andoni* E. of Bonny. They speak a radically distinct negro language, which, however, has been subject to Bantu influences, so that the Efik serves as a connecting link between the true Negro tongue of W. Soudan and the Bantu family on their eastern frontier. At this point the linguistic parting-line is the Rio del Rey, which flows N. and W. of the Cameron Mountains, and reaches the coast at the head of the Bight of Benin.

Eft, Evvet, correct, though local, forms of newt (q.v.). The latter word really stands for *an evnt*; the Mid. Eng. *evnte* was contracted from an earlier *evete*, from the A.-S. *efeta* = a lizard.

Egba (EBBA), a large negro nation of Yorubaland, who occupy the middle Ogun basin due N. of Lagos, and whose capital is the great city of Abéokuta. The Egbas are perhaps the most cultured of all the Yoruba peoples [YORUBA], and their language, spoken with considerable dialectic diversity, is current all over the Yoruba country. The form that prevails along the right bank of the Lower Niger has been adopted by the Protestant missionaries as the general literary standard for their grammars, dictionaries, and translations of the Bible. Many of the Egbas have become Christians, and in recent years the Mohammedans from Soudan have also acquired considerable influence

amongst these industrial and agricultural populations. The trading caravans organised by the Egbas of Abeokuta have already penetrated as far north as Timbuctoo and beyond the Niger westwards to Lake Chad.

Egbert became king of Wessex in 800, in succession to the usurper Brihtic, who had compelled him to take refuge at the courts of Offa, King of Mercia, and the Emperor Charlemagne successively. In 827 he subdued the other kingdoms, and reigned as king of all England till his death ten years later. The Danish invaders gave him much trouble in the latter part of his reign.

Egede, HANS (1686-1758), a Norwegian missionary born at Harstad. He is called the "Apostle of Greenland" for his efforts to establish Christianity in that country. He sailed in 1721 with a Danish commission as royal missionary, and after many difficulties settled with his wife and two sons, and gave himself up to studying the language and manners of the Greenlanders, and to trying to gain their confidence. He returned to Denmark in 1736, and was made director of the missions, his son being appointed missionary. His writings give much information touching the natural history of Greenland. **PAUL** (1708-1789), son of the above, worked with his father from an early age, and retired from Greenland in 1740. He published an account of Greenland, a grammar and a dictionary of the language, and translations of many theological works including the *Imitatio Christi*.

Eger, a Bohemian town on the right bank of the river Eger, 91 miles W. of Prague, and the centre of the railway system of S.W. Bohemia. It was once fortified, but the defences were destroyed in 1809, the only remains being some fragments and a tower, chapel, and part of the great hall of the citadel. There are some manufactures. Wallenstein was assassinated here in 1654. An avenue three miles long leads to Franzensbrunnen. The river rises in Bavaria 12 miles N.W. of the town, and has a course of 124 miles S.E. and then N.E. into the Elbe.

Egeria, a nymph in the early history of Rome who was said to have counselled Numa, and to have given him the laws which afterwards governed the state. She received divine honours.

Egg, or **OVUM**, the germ or female element in the process of sexual reproduction. Such a process and such a structure occurs in most groups of both plants and animals, and the latter in its earliest stage, before impregnation, consists of a single minute primordial cell or but slightly differentiated rounded mass of protoplasm. Perhaps its most rudimentary type is the "zygospore" (q.v.) of the common grey mould *Mucor* or of the algal *Mesocarpus*, in which two filaments approach one another and put out processes which become coalescent, the spore forming between the two filaments, with no appreciable distinction of sex. Such algae as *Spirgyra*, where the entire protoplasm of one cell (male) passes into the other (female), mark a step in advance. The bladder-wrack (*Fucus*), in which eight spherical "oospheres"

are liberated by the bursting of their mother-cell and are fertilised in the water by numerous relatively minute ciliated antherozoids (q.v.), presents a case more resembling that of most of the animal series. Higher in the plant-world the egg or oosphere is fertilised whilst still within a cavity at the base of a trichogyne or of an archegonium; and in the highest group of all, the flowering plants, the fertilised oosphere does not give rise directly by its division to the embryo (q.v.), but forms a chain of cells or suspensor, from the end of which the embryo originates.

Among animals the ovum or germ-cell commonly remains unicellular until impregnation, and then undergoes "segmentation," which gives rise to the yolk; and it may also become surrounded by albumen or "white," and by a "shell," either membranous or calcareous.

The number of eggs produced at one time is very variable—from 30 to 50 in the case of the snail, to tens of thousands in that of the whelk; 60 a minute or 80,000 a day in that of the queen termite, continuing for two years; nearly 2,000,000 in the oyster, and nearly 5,000,000 in the cod. The common snake lays about 20 eggs, the crocodile 25, and the turtle 150 to 200. Domestic poultry lay one egg daily for 120 to 150 days; but wild birds lay but a small number in each season.

In size, the eggs of insects, from which the larvæ emerge in a very immature state, are minute, as also are those of crustaceans, fish, and mammals. Most mollusks have minute eggs, but those of some species of whelk (*Buccinum*) and others are larger than those of many birds. In this latter group, the young attain an advanced stage of development before leaving the egg, and here we have the largest and most highly organised eggs, with yolk, albumen, and shell. The egg of the ostrich weighs as much as three dozen fowl's eggs; that of the moa (*DINORNIS*) is still larger, and that of extinct *Æpyornis* of Madagascar contained as much as 148 fowl's eggs.

Eggs are generally round and smooth, but those of insects vary in form, and are often spiny or tuberculate. Turtles have nearly spherical; crocodiles and snakes, oval eggs. Most birds' eggs are smaller at one end than at the other; but those of fowls are spheroidal, those of ducks, oval; and those of most sea-fowl, pear-shaped.

Impregnation may take place subsequently to the extrusion of the egg, when, of course, the whole development of the young goes on outside the body of the parent; or it may occur before extrusion. In the latter case hatching may take place outside, only a slight development, such as the formation of the "tread" or *cloacitacula* in the hen's egg, taking place beforehand. Both these cases are termed *oviparous*. On the other hand, the eggs may be retained in the oviduct until the young are ready to leave, when the animal is termed *ovoviviparous*; or, the young leaves the egg and is nourished for a considerable time within the womb of the female by the close apposition of certain vascular appendages of its body to the walls of that cavity, when the animal is termed *viviparous*.

Eggs also differ considerably in the characters of their outer coverings. Many molluscs have their eggs enclosed many together in a leathery cup, which is either single, as in *Purpura*, or one of a compound mass of cups, as in the common whelk. Sharks and rays have their eggs enclosed in a four-cornered leathery pouch with mooring tendrils at its corners, familiar, when empty, on the beach, as "mermaids' purses." The eggs of frogs and toads are surrounded by a tough albuminous layer, which becomes gelatinous in water: those of snakes and lizards are parchment-like; and those of turtles and crocodiles have a calcareous shell like those of birds. Birds' eggs, though often white, are coloured in many kinds, rarely uniformly, as in the dark green of that of the emu, but commonly spotted or lined with black, brown, green, or red. The mottling often serves a protective purpose, as in the eggs of plovers and those of various sea-birds, which are left exposed among pebbles, and closely resemble them.

Cod's roe is used as food and as bait; that of the sturgeon is made into *caviare*. The eggs of the crocodile and turtle are esteemed articles of food, as are those of many birds, especially the ostrich, plover, turkey, duck, and fowl. The importation of hen's eggs from France and Belgium is an important and rapidly growing industry.

Egg Bird, a popular name for several sea-birds that have common breeding-places, and whose eggs are gathered for food. The term is specially applied to *Sterna fuliginosa*, the Sooty Tern, which frequents Ascension Island in countless numbers in the breeding season.

Egg Plant, the white-fruited variety of the Aubergine (q.v.) or Brinjal (*Solanum esculentum* or *Melongena*), the fruit of which is highly esteemed as an article of food in France.

Eginhard (770-840), the biographer of Charlemagne, was born near the river Maine, and educated at the monastery of Fulda. As he was of noble family and displayed talent, he was introduced at Court, and was much trusted by the emperor, who made him a Minister, and gave him charge of public buildings. In 806 he went to Rome as Charlemagne's ambassador, and Charlemagne's son, the emperor Louis, made him tutor to his son, and retained him in his public office. Eginhard's wife was Emma or Imma, whom tradition upon very slight foundation represents as a daughter of Charlemagne, and the heroine of a romantic story. Eginhard retired from Court in 830, and soon after his wife, who gave him valuable aid in his work, died. Besides his *Vita Caroli Magni*, there are extant *Annales Francorum*; *Epistolæ* and a history of the translation of the relics of SS. Marcellinus and Peter.

Eglinton, ARCHIBALD WILLIAM MONTGOMERIE, EARL OF (1812-1861), was born at Palermo, and succeeded to the earldom at the death of his grandfather, in 1819. He was educated at Eton, and was a Conservative in politics. For a time he devoted himself to the turf, and in 1839 planned the famous Eglinton tournament. He was

Lord-Lieutenant of Ireland in the Derby administration of 1852, and again in that of 1858. He was a popular Viceroy, and during his second tenure of office he was made Earl of Eglinton.

Egmont, LAMORAL, COUNT (1522-1568), an illustrious Hollander, who is looked on as a martyr-patriot of the Low Countries. Having entered the army, he did good service under Charles V., and accompanied him to Africa in 1544. Under Philip II. he also distinguished himself in the battles of St. Quentin (1557) and Gravelines (1558). When, under the regency of Margaret of Parma, the nobles under the Prince of Orange conspired, Egmont tried to reconcile his duty to his country with that to the court he had so long served. The Duke of Alva caused the Counts Egmont and Hoorn to be beheaded, more, it would seem, with the politic idea of awing the insurgents than from any real belief in Egmont's disloyalty. While warmly attached to his country and to the members of the discontented faction, he was at the same time loyal to Spain and a staunch Catholic. Between the two stools he came to the ground.

Egret, a name for those birds of the genus *Ardea* that have white plumage, and develop delicate crests and plumes on the back during the breeding season.

Egypt. *Geography and Physical Features*. Egypt occupies the north-eastern corner of the continent of Africa, and has on the N. the Mediterranean, on the S. Nubia, on the E. the Red Sea, and on the W. the Libyan desert. It is attached to the S.W. corner of Asia by the Isthmus of Suez. Egypt proper extends from the Mediterranean up the river Nile as far as Assuân (24° N.). In ancient times it was divided into two parts, the northern portion (the Delta) being Lower Egypt (now known as *Masr el Bahri*), and the southern portion Upper Egypt (now *el Said*). The old native name of the country was Kemi. With the Libyan and Arabian deserts, Egypt has an area of 400,000 square miles. The only habitable portions, however, are the Delta, the narrow green strip on the banks of the Nile, and the oases. These amount to about 11,800 square miles in all, 6,600 being in the Delta, and 5,200 along the river-banks (reckoning to the first cataract), and around the lake of the Fayoum. The Nile (which is, after the Amazon, the longest river in the world) is the one source of what fertility Egypt possesses. About 3,300 miles of its course are known, and it is navigable (with the exception of two great interruptions) throughout the whole of that distance. The "father of rivers" is formed by the confluence of the White and the Blue Nile at the modern town of Khartoum, and traverses, in a northerly direction, an absolutely barren country, receiving, in its course to the sea—a distance of more than 1,800 miles—one tributary only, the Atbara, on the E. side, about 180 miles N. of Khartoum. Islands occur here and there along its course. The Nile flows into the Mediterranean by several channels, the most important being the Phatnitic mouth, near Damietta (the principal eastern outlet), and the Bolbitinic or Rosetta mouth,

near Rosetta or Reshid (the principal western outlet). The Nile-outlets of the Delta, however, have probably frequently changed their course since ancient times. With the exception of the Delta and the river-banks, the country is very barren, and consists of sand-hills, with oases* here and there. The country was anciently divided into nomes, of which the number varied at different periods. The Egyptian lists mention forty-four, but of these, two in Upper Egypt and three in Lower Egypt are mentioned twice. The principal cities in Upper Egypt were Abu (Elephantine), Ni Amon (No Amon or Thebes), Qefti (Koptos), Tan ta rer (Tentyris, now Dendera), Tin (Abydos), Siaut (Lycopolis, now Assiout), etc.; and those of Lower Egypt Men Nofer (Memphis), Saï (Sais), Ha ta hir ab (Athribis, now Tel Atrib), Anu (On or Heliopolis), Zoan pi-Ramses (Tanis), Pi-Thut (Hermopolis), Pi-Bast (Bubastis, now Tel Basta), etc. The portions watered by the Nile are of extreme fertility, and the Egyptians early learned to control its course and turn its precious flood, with its fertilising mud, to the best advantage, storing it and conducting it to the fields by means of a network of water-channels. The oases were then, as now, fertilised by means of wells. The period of the inundation lasts from the end of June until the end of October. From this time to the end of February the crops are growing, and harvest lasts from the end of February until the end of June. Occasionally two crops are yielded by the same field in the same season, but they must differ in kind, so as not to exhaust the land. In the winter season the crops are wheat, barley, clover, and broad beans; in the summer season rice, indigo, grapes, cucumbers, melons, and tobacco; and in the autumn season maize, Indian millet, and sometimes sesame. The vegetation, with which the Delta is clothed in June and July, is wonderfully rich and beautiful, the many magnificent trees affording a most agreeable shade from the fierce rays of the sun. Besides the above-mentioned produce, cotton, flax, hemp, lettuce, chicory, sugar-cane, the date-palm (twenty-seven different kinds of dates are usually offered for sale), pomegranates, together with many of the fruits familiar in Europe, are plentiful. Besides the horse (generally of insignificant appearance), the ass, the buffalo, the ox, and most of the domestic animals of Europe are common. Many beasts of prey (jackals, foxes, hyenas, etc.) and birds (including the "sultan-bird" and the "golden snipe") also abound. Crocodiles are gradually disappearing before the march of modern civilisation, but they are still to be found sometimes in the valley of the Nile above Girgeh, and more frequently between the cataracts of Assuân and Wâdi-Halfa.

Recent Discoveries. Egypt has remained known to the world as a land of wonders from the earliest times. The Greeks, when they visited Egypt, were much struck by the pyramids, which they always described, and even imitated in their own country. Herodotus's description of the wonders of this

country is well known, and, according to Pliny, the Pyramids were also described by Euhemerus, Aristogyrus, Dionysius, Alexander Polyhistor, Antisthenes, and others, besides Strabo, Diodorus, etc. Many Arabian chroniclers have written about Egypt, from El-Mas'ûdi, of Fostât, who died in 956, to 'Abdellatif, a physician of Baghdad, who died in 1232. Real researches, however, were not made until the nineteenth century. A great impulse was given to the study of Egyptian by the discovery of the Rosetta-stone in 1799 by M. Bouchard, a French captain of engineers. This monument was found in Fort St. Julien. The first to study this important document was Dr. T. Young in 1819. He was followed by Champollion, the celebrated French scholar, who prosecuted his researches with such marvellous success that he may be regarded as taking the highest rank among all Egyptologists. Since his time many workers have come into the field, and, with the researches of such men as Lepsius, Mariette, Brugsch, Ebers, Goodwin, Birch, Renouf, Erman, and others, the science of Egyptology has been placed on a firm basis, though much still remains to be done. The first modern traveller who carefully and successfully examined the Pyramids was Nicholas Shaw, in 1721; and he was of opinion that there was a subterranean communication between the Sphinx and the Great Pyramid. Various other explorers followed, among whom may be mentioned Pococke in 1743, Davison in 1763, Hamilton in 1801. Belzoni† thoroughly explored the interior of the Second Pyramid (that of Chephren) in 1817. He also discovered the tomb of Seti I. at Thebes, and opened the rock-temples of Abu-Simbel. Other eminent explorers were Sir Gardner Wilkinson in 1831, Colonel Howard Vyse and Mr. Perring in 1837 and 1838. Lepsius, the great German Egyptologist, made many important discoveries between the years 1842-45, and found no fewer than thirty pyramids which had been unknown to previous travellers. M. Mariette, director of the Khedival Museum (formerly at Boulak, now at Gizeh), explored the burial-places of Sakkâra, which yielded many treasures. The Sphinx was first excavated by Caviglia in 1817 at the cost of an English society, and again recently by M. Mariette. Lately many interesting discoveries have been made by Professor E. Naville and Mr. Flinders Petrie, assisted by Messrs. Griffith and Newberry, for the Egyptian Exploration Fund, on the sites of Pithom (Pi-Tum) in Lower Egypt, Tel-el-Amarna in Upper Egypt, etc. This last-named site, which was the capital of the heretic-king Khu-en-aten, is the place where the now renowned Tel-el-Amarna tablets, which are mostly letters concerning affairs in Palestine before the entry of the Jews into the Holy Land were found. Excavations are still being carried on by the above-named fund, which has done such good work.

Language and Literature. Our knowledge of the Egyptian language dates from the time when

* The oases lie at a considerably lower level than the surrounding country, that of Siwa being nearly 80 feet below the sea-level.

† This celebrated explorer had a most remarkable career, and made many discoveries in the Land of the Pharaohs. His life was one full of romance.

Young and Champollion published their studies of the Rosetta Stone, in 1817 and 1822. This inscription, which is now preserved in the British Museum, is of black basalt. It bears, in three different styles of writing—the sacred hieroglyphic, the popular or demotic, and the Greek language and character—a decree of the priests in honour of



MAP OF EGYPT.

Ptolemy V. Epiphanes (B.C. 204–181), issued when the king was still a boy of 14. The last paragraph of the Greek version tells us that we shall find the two translations, one in the sacred, and the other in the popular language of Egypt, adjacent to it. The Egyptian alphabet was first found by comparing the names of the kings, which are distinguished in Egyptian inscriptions by being enclosed in frames called cartouches. The origin of the Egyptian system of hieroglyphs is lost in antiquity. It consists, however, of an alphabet of about twenty-five characters (mostly pictures of natural objects), and a large number of syllabic characters, also pictures, which stand for the objects represented, the reading of the texts being facilitated by phonetic complements, and a large number of determinatives indicating the nature of the object or action expressed. These determinatives, as may be imagined, have proved to be of immense value in translating the inscriptions and perfecting the vocabulary of this archaic language. The Egyptian language is to a large extent monosyllabic and agglutinative, and its pronouns, verbal forms, and some of the roots, resemble closely the Semitic tongues. Coptic is a modern development of the old Egyptian language. Besides stone, which was largely used for inscriptions, the Egyptians used papyrus, made from a plant now no longer to be

found in Lower Egypt, though it is met with farther inland. Egyptian literature consists of historical inscriptions, hymns to the gods, treatises on morals and rhetoric, medical works (containing also charms and incantations), works on geometry, mensuration, and arithmetic; also reports and indictments, registers of gifts to the temples, and of objects received by the Crown or by private individuals. Many contracts in demotic writing also exist. Besides the above, there are novels, such as the tale of the Two Brothers, the tale of the Possessed Princess; also the book of the Lamentations or Sighs of Isis, and the well-known funeral compilation—the book of the dead. Poetry of a heroic nature is represented by the compositions of Pentaur, Amen-em-apt, and others (time of Rameses II.). Travel is represented by the adventures of Sinuhit when fleeing from his enemies, and the Travels of an Egyptian. Altogether the Egyptians possessed an excellent and very varied literature, which, but for the untoward decrees of fate, might have developed into something of a higher and better class.

History. The history of Egypt can probably be traced back to a more remote period than that of any other nation. Manetho, the Egyptian priest of Sebennytus (now *Semmenûd*) gives thirty dynasties from Menes to the time of Nectanebo II. (340 B.C.), extending over a period of 3,555 (better 3,553) years. The most probable date for the foundation of the kingdom is therefore about 3893 B.C. This primeval monarchy, of which Menes was the first king, followed the mythical period. Menes is said to have been the founder of Mennofer or Memphis, the Biblical Noph (in Hos. ix. 6, Moph), which was the capital until the 6th dynasty (about 2956 B.C.), and attained its greatest prosperity under Menes' son Athothis and his successors. Snefru, the first king of whom contemporary monuments are known, was the founder of the 4th dynasty. He conquered the tribes of the Peninsula of Sinai, and discovered the mines there. Khufu (Cheops), Khâfrâ (Chephren), and Menkarâ (Mycerinus) ruled in succession after him, and were the builders of the three great pyramids of Gizeh. The last king of the 5th dynasty, Unas (Onnos), built the great truncated pyramid ("Mastabat el Faraoun") near Dashoor. With this dynasty the supremacy of Memphis ends for a time, and Elephantine comes to the fore, the principal ruler being Pepti, celebrated for his conquests, his pyramid, and the prosperity of his reign. He was succeeded by the beautiful queen Nitocris, about whom Herodotus tells wonderful stories. New glory came to Egypt with the 12th dynasty, under which the sceptres of Upper and Lower Egypt were united, and a revival in the art of the country took place. Amen-em-hat I. (about 2350 B.C.) it was who conquered the district of Wawat (supposed to be Ollaki), founded the temple of Amon at Thebes, and adorned the other holy places of his land. This king left to his son a document (still in existence) depicting the time and the men, as an admonition to his offspring who was to succeed him. Useratesen (Sesonchosis), his son, continued his father's work, conciliating the people, and restoring the temples. His armies

were successful in Wádi-Halfa in Nubia, and colonists were sent to work the turquoise and copper mines in the Sinaitic peninsula. Amenem-hat III. (Gk. Ameris, about 2230 B.C.) constructed Lake Moeris and founded the Labyrinth. He was a peaceful ruler, and the country seems to have prospered under him. During the time of the 12th dynasty Semitic families applied for permission to enter Upper Egypt,* and during the time of the 13th dynasty these immigrations became more frequent, and they became at last so powerful as to obtain possession of Lower Egypt, and founded the dynasties of the Hyksos or Shepherd-Kings. For five centuries they ruled over the country, making Tanis (Zoan) and Avaris their chief cities. The native kings, whom they had driven out, reigned over Upper Egypt. These foreign rulers conformed to the ancient culture of the valley of the Nile, and adopted the titles of the Pharaohs and all the courtly ceremonies of the legitimate rulers of the land. It was during this period that Joseph was sold into Egypt, and the favourable treatment which he, and afterwards his father's house, met with, was probably due to their being of the same race as the Pharaoh then ruling. According to Brugsch, the name of the king under whom Joseph served was Nub, a foreign prince who ruled about 1750 B.C., and the famine itself, which took place under Joseph's administration, is, according to the same authority, that mentioned by an official named Baba in an inscription in which, according to the custom in Egypt, he gives a list of his services to his king and country. The Hyksos dominion lasted for five centuries, one of the last rulers being Apap or Aphophis. This king demanded the cession of an important well from Rasenen, the king of Upper Egypt, and the result of this was a war of independence which lasted eighty years, and which ended in the establishment of the native dynasty (the 18th) on the throne of the country, the struggle ending by the capture, by Aahmes I. (Amosis or Amasis) of Abaris, after a long siege by land and water. The forces of the Hyksos, numbering 24,000 men, were compelled to retreat, and to seek a new home in southern Palestine (about 1700 B.C.). To this dynasty belong the three Thothmes, the last of whom extended his conquests as far as the vicinity of the Tigris; and Amenophis III. and IV. The former continued to exact tribute from the nations of Western Asia as far as Mesopotamia, and extended his dominions on the south. He was also a great builder. Amenophis IV. is noted for having returned, doubtless under Semitic influence, to the earlier and ruder worship of the sun, and in accordance with this idea, re-named himself Khu-en-aten, "the reflection of the sun's disc." It is to the reign of these two kings that the tablets in the cuneiform character found at Tel-el-Amarna belong. They throw a flood of light upon Egyptian affairs in Palestine before the entry of the Jews into the Holy Land.

Not inferior in glory to the 18th was the 19th dynasty, to which belonged the earlier Ramessides.

The reign of Ramesses I. was not remarkable, but his successor, Seti I. (Menepthah) made campaigns against the Aramaic tribes, who were in league with the Kheta or Hittites, and penetrated as far as the Orontes. He built the Memnonium at Abydos, had a sepulchre prepared for himself, hewn in the rock, at Thebes, and completed the great irrigation-canal in Goshen. Ramesses, his son and successor, he caused to be educated along with the young Egyptian nobility, of whom, it is supposed, Moses was one (Exod. ii. 10). The reign of Ramesses II. was an exceedingly brilliant one. He carried his arms to Donkola on the S., Asia Minor on the N., and the Tigris on the E., and erected monuments of his victories in various parts of the countries he had conquered. Among his buildings may be mentioned the Ramesseum at Thebes, the temples at Abydos, Thebes, and Memphis, and the wonderful rock-hewn temple of Abu-simbel. It is this ruler who is generally regarded as the Pharaoh of the oppression of the Israelites—an oppression due to the fact that the last-named were of the same race as the hated and heretic Hyksos, and confirmed by the discovery by M. Naville of the treasure-city of Pithom, which was built by the Israelites, and the monuments of which bear the name of Ramesses II.* A great literary revival took place during this reign. Menepthah II., who succeeded him, is generally regarded as the Pharaoh of the Exodus. This king was on good terms with the Kheta or Hittites, and turned his arms against the Libyans, whom he defeated. The architectural works of his reign are mean, and he was in the habit of carving his own name on the ancient monuments of his predecessors. It is not unlikely that the exodus of the Israelites from Egypt was due to, or facilitated by, external troubles, namely, the people of Canaan throwing off the Egyptian yoke. The residence of the kings of the dynasty to which Menepthah belonged seems to have been Tanis or Zoan, thus confirming the statement in Psalm lxxviii. 43, where God's "wonders in the field of Zoan" are sung. Towards the end of the 19th dynasty troubles occurred in the country, several pretenders to the throne (one of them a Phœnician) appearing, and the worship of the gods being neglected. A revival took place, however, with the next (the 20th) dynasty, the first king of which was Ramesses III. or Ramesseu-pa-nuter, "Ramesses the god" (Gk. Rhampsinitus), who began to reign about 1273 B.C.

He warred with the Libyan and Maxyan invaders of his land, and opened, by means of his fleet and the caravan-routes, intercourse by sea and land with India. The monument of this King at Bibân-el-Mulûk, near Thebes, is one of the finest now extant. With Ramesses XII. the 20th dynasty apparently ends, the throne of the Ramessides being usurped by ambitious hierarchs of Tanis, headed by Herhor, the chief prophet of Amon, who now became king, the legitimate line having been banished to the Great Oasis. This line of priest-kings reigned ingloriously, and were unable to exact obedience from their vassals by force, and tried, therefore, a conciliatory policy.

* It was probably about this time that Abram and Sarai entered the country.

* His mummy is now in the museum of Gizeh.

It is supposed that it was a daughter of a prince of this line that Solomon married, receiving from the prince the many favours mentioned in 1 Kings iii. 1; ix. 16; x. 28. Shishak or Sheshonq I., the founder of the twenty-second dynasty (965 B.C.) is supposed to have been of foreign (Assyrian or Elamite*) origin. This king assisted Jeroboam, one of Solomon's "adversaries" (1 Kings xi. 26, 40) against Rehoboam, the son and successor of the Jewish ruler. Jerusalem was captured (1 Kings xiv. 25-26) and the Temple spoiled. The story of his conquests, with a list of the towns in Judah and Israel which he captured, is inscribed on the south wall of the Temple of Amon at Karnak. Sheshong I. was succeeded (933 B.C.) by Osorkon I., supposed to be the same as the Zerah of 2 Chr. xiv. 9, who invaded Palestine, and was defeated by Asa. The native inscriptions tell us nothing of this king. After a contest between his two sons, the elder, Taklath, ascended the throne (B.C. 900), but, like many of his successors, his reign seems to have been uneventful. Bok-en-ranf (Gk. Bocchoris), of the twenty-fourth dynasty (725 B.C.), tried in vain to arrest the decline of the empire by a new legislation, but the country fell at last into the hands of the Ethiopians. Shabaq, the Biblical So, made an alliance with Hoshea of Israel (2 Kings xvii. 4), and conquered Nubia and Upper Egypt. Sabatok was defeated by Sargon of Assyria at Raphia in 720 B.C. Tirhakah, about 685 B.C., conquered Lower Egypt, and, going to the help of Hezekiah, fought with Sennacherib, King of Assyria, near Eltakeh. Later, he was defeated by Esarhaddon, who took possession of Lower Egypt. Both Esarhaddon and his son Assurbanipal, however, tried in vain to hold the country. Twelve vassal princes (the Dodekarchs), headed by Psammetichus, son of Necho, revolted against the overlordship of Assurbanipal, King of Assyria, and, being successful, ascended the throne, and founded the twenty-sixth dynasty (about 665 B.C.). This king, in order to consolidate his empire, favoured foreigners, especially Greeks, in many ways. This proceeding greatly offended the warrior-caste of Egypt, and they emigrated, therefore, to Ethiopia, and founded there the kingdom of the Sembrides. Psammetichus made war upon the wealthy seaports of Phœnicia, but met with a determined resistance. Necho, his son and successor (612 B.C.), though a warrior, sought also the internal welfare of his country. He began to construct a canal from the Nile to the Red Sea, but discontinued the work on being told by an oracle that it would only benefit "strangers." When the Medes and Babylonians attacked Assyria, he also took the field against the devoted country, and defeated Josiah, the ally of the Assyrians, at Megiddo (2 Kings xxiii. 29). Nineveh having fallen, however, Necho's further progress was stopped by Nebuchadnezzar, who defeated him at Carchemish. Necho afterwards deposed Jehoahaz, whom he imprisoned at Riblah, exacted a fine from the country, and placed Jehoiachim on the throne in his stead

(2 Kings xxiii. 31-35). Hophra or Apries (591-570 B.C.) captured Sidon, and marched to the relief of Zedekiah when the latter was attacked by Nebuchadnezzar (Jer. xxxvii. 5, 7, 11). After the capture of Jerusalem by the Babylonian king, Hophra accorded an asylum to the exiled inhabitants. In consequence of a defeat at the hands of the Cyrenians, his army revolted against him, and placed Aahmes or Amasis on the throne. This king had a prosperous reign, though he seems once to have come into conflict with Nebuchadnezzar. On the death of Amasis in 526 B.C., Psammetichus III., his son, was defeated by Cambyses at Pelusium; Memphis was taken, and Egypt was reduced to the condition of a Persian province. Psammetichus was afterwards executed for attempting to organise an insurrection to throw off the foreign yoke. After this period revolts against the dominion of the Persians occurred from time to time, and certain native rulers maintained a precarious independence. The country passed, however, from the rule of the Persians to that of the Greeks, the Romans, the Byzantines, and the Mohammedans, under which last it has remained. The Egyptians were from the first very favourable to Christianity, and this ultimately took the place of the old heathen religion. On the conquest of the country by the Mohammedans, a number of Arab tribes settled in the Nile valley, and many of the Copts embraced Islām. Egypt was taken possession of by the French in 1798, who were compelled by the English to evacuate the country in 1801. Mohammed-'Ali came to the pashalic of Egypt in 1805, and under his reign much improvement in the state of the country was effected. This progress was continued under Said Pasha (1854) and Ismail Pasha (1863), who was raised to the rank of Khedive in 1867. His projects for the development of the country failed financially, and the English and French Governments intervened (from 1875 on) in the interest of the bond-holders. In 1879 an English and a French Controller-General were appointed, with seats in the Egyptian Cabinet and extensive powers. Ismail was deposed and replaced as Khedive by his son Tewfik. A military and nationalist rebellion, headed by Arabi Pasha, was suppressed by English intervention, by the bombardment of Alexandria and the battle of Tel-el-Kebir, July, 1882. As France had refused to join in this intervention, the Dual Control was abolished by the Khedive (1883) and an English financial adviser appointed, without whose advice no important step can be taken. An English army (now about 5,000) has been stationed in Egypt since 1882, and in 1896-97 operations were begun against the Mahdi; these were attended with success, culminating in the battle of Omdurman (1898), and British and Egyptian authority was re-established over some of the provinces of the Soudan temporarily abandoned. Tewfik died in 1892, and was succeeded by his son Abbas.

Religion. The religious ideas of the Egyptians were chiefly connected with the worship of the sun, in morning-time as Har or Harmachis, at midday as Ra, and in evening or at sunset as Tmu. The sun-god in Egyptian mythology floated in a boat

* According to the form, Sheshonq means "he of Susa," the capital of Elam.

through the sky or celestial ether, and descended at night to the dark regions of Hades, through which he passed. According to the inner teaching of the Egyptian priesthood, Ra was the great Universe, and the other gods merely personifications of his attributes, thus making a kind of monotheism, which was the belief of the initiated. Ra is sometimes called the soul of Osiris, who was, therefore, a form of the sun. Osiris was regarded as the principle of life, a pure and perfect being, personifying the good and the beautiful. The principal of evil was represented by Set or Typhon, brother and rival of Osiris. Lower in the scale were Tahuti or Thoth, god of wisdom; Anubis, son of Osiris, director of funeral rites, etc. Other deities were Khnum or Chnubis, god of fertility; Ma, goddess of truth; Nephthis, wife of Set or Typhon; Safekh, associated with Thoth, and goddess of writing and history; Sekhet, Bast (or Pasht) (with the lion's head), to whom the cat was sacred, personified sexual passion; Isis, Muth, and Athor, though externally regarded as separate, were really three different forms of the same fundamental idea. Isis was sister and wife of Osiris, and the goddess of the good and the beautiful. Muth was the great mother and birth-giver. Athor or Hathor (Hathor, "the abode of Horus") was the consort of Har or Horus, goddess of love and dispenser of the blessings of life. Her sacred animal was the cow, and for that reason she generally appears represented with a cow's head. Constant sacrifices were offered to the gods, all religious rites being celebrated with great pomp, and on such occasions a great deal of food was consumed or given away. The priests and their families drew rations from the temples, and the priests of the Pharaohs were supported at the charge of all the temples. In addition to the priests, there were four orders of prophets, those of ability being promoted from the lower to the higher. Like the Assyrians, the Egyptians were exceedingly religious, invoking their deities in almost every inscription, and all the acts of the rulers are attributed to divine assistance.

The Arts. The Egyptians excelled greatly in architecture, sculpture, painting, engraving on stone, agriculture, and many industrial arts. The country was full of magnificent architectural triumphs such as no other nation could show. Their temples were vast structures of hewn stone, built upon the grandest scale, and dwarfing the Greek on comparison. Gigantic columns, with lotus or papyrus capitals, towered to a great height, often reaching 60 feet. Sometimes the temples of the gods were hewn, as at Abu-Simbel, in the solid rock. Bas-reliefs were to be found everywhere in these structures, and were brightly coloured. Scenes of devotion, pictures of mythological import, and representations of battles, tribute-bearers, vassals, captives, appear in profusion. Not less successful were they in sculpture in the round, as is shown by the large number of still extant statues of kings, divinities, and private individuals. No difficulties baffled them; the hardest granite, as well as the softest limestone, were carved into the required shape, according to the canon of proportion which was observed by the sculptors. There is certainly

a great sameness about their work, but the few portrait-statues which are known show us what the Egyptians could do when they freed themselves from the trammels of their rigid canon. Besides these monuments, which will probably testify to their skill as long as a civilised nation inhabits the earth, examples of their carpentry exist such as would not disgrace our own time. Specimens of pottery with the celebrated blue and green glaze are also to be seen in our museums; whilst as artificers in bronze, and metals in general, they were probably unsurpassed. Models of houses show what their habitations were like; models of funeral boats indicate faithfully how they performed the sacred duty of carrying their dead to the last resting-place, in the tombs on the banks of the Nile—Memphis, Abydos, or Gournah. The Egyptians were excellent weavers and good agriculturists; and the annual inundation, obliterating as it did all landmarks, necessitated a knowledge of geometry (land-measuring).

Manners and Customs. In domestic life the Egyptian was much attached to his wife and children. Egyptian women seem to have been always the equals of the men, having the same rights and privileges. Both sexes sat, when at meals, at table—either on chairs or on the ground, never reclining as did the Greeks. Children under the age of puberty went undressed, but on reaching that age assumed clothes, and wore a peculiar lock of hair on the left side of the head. Men wore a short fluted garment round the loins, but persons of high rank wore garments of fine linen which reached as far as the ankles, and were provided with full sleeves. The wearing of sandals became general (with some exceptions) after about 3000 B.C., and they were made of leather, palm-fibres, or papyrus (the priests wore only the last-named). The hair and beard were generally shaved. Both men and women wore collars of beads and chains of gold around the neck, as well as armlets and bracelets. As a nation they were very polite and hospitable.

The belief in the immortality of the soul led to the practice of embalming the dead. In this process all the viscera and softer parts of the body were removed, and the body itself was soaked in various salts and resins. Bandages of linen were then carefully wound around it, and it was placed in a gaily-painted and often elaborately-gilded coffin, or a richly-sculptured sarcophagus. After the performance of the service for the dead, hired mourners made lamentation, as is usual in the East. Having been placed aboard a funeral boat, it was floated down the Nile to some favourite cemetery, and consigned, with numbers of small porcelain figures called *ushabti*, to the family tomb. A copy of the Ritual or Book of the Dead was placed with the mummy before it was put into the coffin. At the religious festivals, which took place at stated periods, the arks of the gods were carried in procession, sacrificial offerings were placed on the altars, and hymns and prayers were chanted to the gods. All things connected with temples and worship were in the hands of the priests and priestesses, and the high priest of Amon at Thebes (who was also called the chief prophet) was second

only to the king. Beneath the prophets was an order called the divine fathers, and sacred scribes acted as clerks and kept the accounts. Each temple had servants and slaves attached to it.

Present Condition. The ancient kingdom of Egypt is now governed by the Khedive, whose suzerain is the Sultan of Turkey. Egypt Proper is administratively divided into five governorships of principal towns, and fifteen provinces, each province being governed by a Mudir, whose duties are very multifarious. The principal modern towns are Cairo (the capital), at the lower apex of the Delta; Alexandria, Damietta, and Port Said (on the coast); Mansura, Melahet el Kebir (both in the Delta), Minyeh, Melawi el 'Arish, Siût or Assiout, Keneh, Assuân, etc., in the southern provinces. Iswailiya, Port Said, and a village near the Serapeum railway-station, owe their origin to the digging of the Suez Canal. The land by the Nile is as fruitful as of yore, and irrigation is ensured by a system of water-wheels (*sakiyeh*) moved by animal power, and by the well-known *shādīf*—a bucket attached to the end of a beam (which is fastened in the middle to a post), and counter-balanced by a weight. Efforts are being made by the English administration to improve the irrigation by a system of *barrage*, which will doubtless have an excellent effect. The Delta is now covered with a network of railways (the first of which was constructed by Stephenson in 1850, under Abbas Pasha), which connect all the important towns, and of which a branch runs along the valley of the Nile past Berber. The dryness of the air, and the beauty of the climate, attract a large number of visitors during the winter months, many of them being invalids in search of health. The climate during the summer is too hot to tempt the ordinary tourist.

Ethnology. Modern Egypt forms ethnologically an extension of the Arabian peninsula, at least so far as regards language, religion, and the nomad section of the population. Arabic has long been the universal language of all the natives; Islâm is almost their exclusive religion, and the pastoral steppes and oases are mostly inhabited by tribes of pure Arab descent. But the great bulk of the settled agricultural classes still belong fundamentally to the old Egyptian stock, which is directly represented by the Copts [COPTS], and which during the former political vicissitudes of the country was little affected in the rural districts by contact with the Persians, the Macedonian Greeks (Ptolemaic dynasty), the Romans, and the Byzantine Greeks. Under its successive conquerors Egypt preserved its nationality, usages, language, and religion almost intact down to the Arab invasion of the 7th century, which forms the starting-point of a fundamental change in these respects. The old religion and language were rapidly replaced by those of the Mohammedan conquerors, while a more gradual and less complete fusion took place between the Hamite (Egyptian) and Semite (Arabian) ethnical elements. In this respect the process of assimilation was reversed, and the Arab intruders became merged in the old agricultural classes. Hence the startling resemblance often presented by the Arab-speaking Mussulman Fellahin

(peasantry) to the primitive Egyptian types, as figured on the very oldest monuments of the Nile valley. On these monuments are represented two well-marked types—one delicate, noble, and regular, in the European sense (Caucasic); the other more coarse and vulgar, with tumid, almost everted lips, and small nose, as if from the dawn of history a fusion had already taken place between the Hamitic intruders and the indigenous Negro inhabitants of the Nile basin. It is the latter type that survives in the Fellahin, and in a still more marked degree in the Copts. The Fellahin (from the Arabic root *falaha* = to toil, to till) still form at least three-fourths of the whole population, which was estimated at the last census at 9,734,405, including about 1,000,000 sedentary Arabs, Turks, Soudanese, and Nubians; 250,000 nomad Arabs and Bejas; 40,000 Greeks; 24,000 Italians; 20,000 Jews; 14,000 French; 10,000 Armenians; 8,000 Austrians and Germans; and 19,000 English. The nomad Bejas [BEJA] occupy the steppes between the Nile and the Red Sea from about the parallel of Kosseir to the Nubian frontier; like all the Bejas, they are divided into a large number of tribal groups, some of Beja, some of Arabic speech, all Mussulmans, stock-breeders, and caravan conductors, and collectively known as *Ababdeh*. All the rest of the eastern and the whole of the western steppes and oases are held by full-blood Arab Bedouins, some of whom have their descent from the first invaders (640 A.D.), but most of whom are more recent arrivals. Their tribal divisions are very numerous, the most important being the Hawâtât Terrabin, Amrân, Aiaideh, Hawâsin, east of the Nile; and the Aulad-Âli, Hanâdi, Goâbi, Aulad-Suleimân, Azaleh, Fergân, and Tarhônâ west of the Nile. Many of these western Bedouins now lead almost sedentary lives, and combine husbandry with pasturage, hence are regarded by the nomads of the wilderness as little better than the despised Fellahin. But their Arab blood is easily recognised in their swarthy complexion, small bright eyes, wiry figures, energetic spirit, and traditional usages.

Egyptian Vulture (*Necophoron percnopterus*), called also Pharaoh's Chicken or Hen, a vulture, about 30 inches long, found in the S. of Europe, ranging into Asia and the N. of Africa, and abundant in Egypt. The general plumage is white, the wings black, and the bare part of the face yellow. It is a very foul feeder and valued as a scavenger.

Ehkili, a term of unknown origin applied by the inhabitants of Mahrah, Makalla, and some other districts of Hadramaut, S. Arabia, to their language, which is of great philological interest. It differs greatly from current Arabic, and represents, in a corrupt form, the primitive Himyaritic speech of Arabia, which survives also in the Tigré and other dialects of Abyssinia on the opposite side of the Red Sea. Ehkili is consequently one of the most primitive dialects of the primordial Semitic language, and in it are composed the numerous rock inscriptions scattered over S. Yemen and Hadramaut. From these imperfectly-deciphered inscriptions and from the specimens of Ehkili

collected by Fresnel and others, it appears that Himyaritic differs more from Arabic than Arabic does from Hebrew, with which language it has much in common. (Fulgence Fresnel, *Note sur la langue himyarite* in *Journal Asiatique*, vi. 79; H. J. Carter, *Notes on the Mahrah Tribe of Southern Arabia* in *Journal of Bombay Asiatic Society*, ii., 1848, p. 339.)

Ehrenbreitstein ("the Broad Stone of Honour"), a Prussian fortress on a height upon the right bank of the Rhine opposite Coblenz, with which it communicates by a bridge of boats and an iron railway bridge. The French blew up the fortress in 1801, and had to pay for its rebuilding in 1816. The fortress will contain a garrison of 14,000, and a year's stores for an army of 60,000, and there is a well communicating with the Rhine. On three sides the fortress is inaccessible.

Eider, a river of Prussia rising near Kiel, and separating Schleswig from Holstein, and falling after a course of about 100 miles, through two-thirds of which it is navigable, into the North Sea. The Schleswig-Holstein canal connects it with the Baltic at Kiel.

Eider Duck (*Somateria*), a genus of marine ducks with five species, breeding socially in Arctic and sub-Arctic regions. The bill is small, with a horny nail at the tip, and extends up on the forehead, where a central line of feathers divides it; tail short and pointed, hind toe lobed. The tertiaries are long and generally curved outward so as to overlap the primaries. The Common or True Eider Duck (*S. mollissima*) is abundant in the Arctic circle in both hemispheres, and sometimes breeds as far south as the Bay of Fundy and the Fern Islands. The male—about two feet long—is slightly larger than the female, and is also more brilliantly plumaged, especially during the breeding season, when the crown of the head is bluish-black, the tail and under surface black, the nape and cheeks siskin-green, the neck and upper surface with a good deal of white, which is replaced by darker hues in the autumn. The young of the year and the females are clothed in rusty brown, barred and spotted with a darker shade. The bill and feet, greenish. The King Eider or King Duck (*S. spectabilis*) is a native of the extreme north of Asia and America, some breeding as far south as Iceland and the Faröes. It occurs also as a rare British visitor. It is about the same size as the Common Eider, which it greatly resembles, but the male has the top of the head grey and the breast flesh-coloured, and there is less white on the back; the bill and feet are rufous brown. These birds are economically important, and both are domesticated in northern regions, the former to a much greater extent than the latter. Their flesh, like that of most sea-birds, is oily, but in the domesticated races this has been to some extent overcome by a mixture of meal with their natural food, which consists of molluscs and crustaceans. The eggs are eaten, and those of the King Duck are of delicate flavour. But it is for their fine grey down, so much used for lining coverlets and quilted

garments, that these birds are chiefly valued. Some of it is, of course, used on the spot where it is gathered, as are the skins for underclothing, but the greater part is sent southward. Iceland and Norway are the chief seats of eider breeding. As soon as the eggs are laid the female plucks the down from her breast to cover them. The nest is then stripped by the collectors, and the bird lays other eggs, which she covers as she did the first, and these, with their covering, are also taken. The third lot, which the male helps to cover, is left, lest the birds should desert the nest. The quantity annually gathered from each nest is, when cleansed, about a quarter of a pound. Down deposited by the female is called "live-down;" that taken from dead birds is of inferior quality, and is known as "dead down."

Eifel, a barren plateau of undulating land in Rhenish Prussia between the Rhine, the Moselle, and the Roer. It is hilly and rugged in the W., and in the N.W., where it joins the Ardennes, but slopes down to the Rhine and the Moselle. The height varies from 1,500 to 2,000 feet, and a ridge of mountains crosses the centre. The formation is Lower Devonian Silurian, with Eifel limestone, containing many fossils, and over is a Triassic formation containing metals. Extinct craters, basalt lava, tufa, and pumice bear witness to volcanic action. There is little agriculture, but some wine and spirits are produced.

Eiffel Tower, a well-known iron structure designed and erected by Gustave Eiffel, the French engineer, on the Champ-de-Mars in Paris. It was built in 1887-89 at an estimated cost of £200,000, of which £60,000 was granted by the Government and the balance provided by the engineer. He holds a concession for 30 years, after which time it passes to the State. It is a structure of open ironwork on a square base tapering upwards with curved outline to a height of 985 feet. There are three storeys, and the passage to the top is effected by lifts. The total weight of iron employed in its construction is about 6,860 tons.

Eilethya, a city of ancient Egypt below Edfu, on the right bank of the Nile, sacred to the goddess Suben—later identified with Lucina—the patroness of Upper Egypt. There are rock-tombs hewn in the rock, and dating from the 13th dynasty and later. One has records of the wars against the Hyksos in the 18th dynasty. There are two very ancient temples, one to Ra, and the other to the local deities, and a temple of the time of the Ptolemys to Lucina. The city was an important outlying fortress.

Eimaks (properly *Char Eimak*, i.e. the Four Tribes), the inhabitants of the western part of the Paropamisian mountains between Kábul and Herat, N. Afghanistan. The four divisions are:—*Taemüni*, S. slope of the Siah Koh, about Gor; *Hazára Zeidnat*, Kalao Nao district, about the head waters of the Murgháb; *Taemüri*, W. of Herat, now mostly within the Persian frontier; *Züri* (*Süri*), on the hills E. of the road from Farah to Herat. The Eimaks are a mixed Mongolo-Tartar people,

who now speak a mediæval form of Persian, and who claim pure Mongol descent. Many still spoke Mongol in Sultan Baber's time (16th century), and the historian Abul Fazl regarded them as the remains of the hordes commanded by Manku Khan, grandson of Jenghiz Khan. In any case, they are of the same race as their eastern neighbours, the Hazâras, though hostile to them, being of the Sûni (orthodox) sect, whereas the Hazâras are Shiâhs. The Eimaks still live almost entirely in "urds," or camps, each of which is administered by a ket-khoda dependent on the khan or chief ruler, who pays reluctant tribute to the Amir of Kâbul; total population about 450,000. (Col. C. M. MacGregor, *Afghanistan*, Calcutta, 1871, pp. 245, et seq.)

Einsiedeln, a Swiss town in the canton of, and 8 miles N.E. of the town of, Schwyz. It is situated upon a plateau 3,000 feet above sea level, and is surrounded by mountains. It has a seminary, and a Benedictine abbey, which was founded in the 10th century, and has a good library of 26,000 volumes. There is a chapel of St. Meinrad, and a colossal image of our Lady. The miraculous image attracts many thousands of pilgrims, and there is a brisk trade in beads, books, and other souvenirs. Zwingli is said to have emptied the convent in 1517 by his sermons against the monastic life. The district produces good horses, and there is a trade with Zurich in wood and turf. The chief industries are dyeing and cloth and wool manufacture.

Eisenach (the *Isenacum* of the Romans), a town and head of a district in the Grand Duchy of Saxe-Weimar, at the junction of the Hoersel and the Nesse, about 48 miles W. of Weimar. It is situated in a valley, surrounded by wooded hills. There are two good churches and a castle, once inhabited by the princes of Saxe-Eisenach. On the height above is the Castle of Wartburg, inhabited by Luther after the Diet of Worms, and his room, chair, table, and writing-desk are still shown. There is some weaving and manufacture of fustians and coarse woollen goods, and there are oil, powder, and seed mills. Sebastian Bach was born here in 1682, and a statue was erected to him in 1884.

Eisleben (anciently *Isalbia*), a Prussian town in the province of Saxe, capital of Mansfeld, on the Bode, about 20 miles N. of Merseburg. Luther was born here, and in the church opposite the house in which he was born is a pulpit from which he used to preach. There are copper and silver mines, foundries, and manufactures of saltpetre, vitriol, and Eisleben green. There are also breweries, and tobacco is manufactured.

Eisteddfod (from a Welsh word meaning a sitting) is the name of a Welsh congress called together for the purpose of musical, poetical, and literary competition, and having for its main object the keeping alive of the national language and customs. In former times the places of meeting were in different districts of Wales according to the place of the bards. Commissions from the kings of Wales, and later from the kings of England, appointed the judges down to 1568, when

the custom of holding Eisteddfodau died out, to be revived in recent years. They are usually very largely attended, occasionally under royal patronage; and to gain a prize at the Eisteddfod is, to a Welsh poet or musician, an honour almost as much esteemed as was that of a winner in the old Grecian games.

Ejectment, the name of the action in which a plaintiff formerly sued to recover possession of real estate, such as land and houses. By the "Common Law Procedure Act, 1852," the title of such action was altered, and the proceedings therein much simplified. It is now known as an action "for recovery of land." The proceedings of the old action of ejectment were of a very technical and abstruse character, the names of "John Doe" and "Richard Roe" (fictitious persons in such action) being still familiar to many. [RECOVERY OF LAND.]

Eka, -boron, -aluminium, names applied by Mendeleef to elements, then undiscovered, but whose existence, on the basis of the Periodic Law (q.v.), he predicted and described. The first was recognised in the element *Scandium* and the second in *Gallium*, both of which were discovered a few years after Mendeleef's prediction.

Ekaterinburg, a Russian town on the Isset, in the government of Perm, 170 miles S.E. of the town of Perm, and upon the east side of the Ural mountains, and in the Ural mining district. It was founded in 1723 by Peter the Great, and is well built. It has a mint, custom-house, mining school, hospital, and botanic gardens. Besides mining, metal-working, and cutlery, there is much polishing and engraving of gems. A bridge over the Isset connects the two parts of the town.

Ekaterinoslav, a Russian town, capital of the government of the same name, on the right bank of the Dnieper, 250 miles N.E. of Odessa. It was founded in 1787 by Prince Potemkin as a summer residence for Catherine II. It is the see of an archbishop, and has a cathedral and a library. The government contains 26,148 square miles.

Eland (*Oreos canna*), the *Impresso* of the natives, a large ox-like antelope living in small herds in Southern and Central Africa, where it is hunted for sport, for its excellent beef-like flesh, and for its hide, valued by the Dutch colonists for making traces. A full-grown bull stands about six feet high at the withers, which are elevated, though there is no "hump," and has a deep dewlap, and a short, stiff mane. Horns, straight and spirally ringed, are present in both sexes, and the tail is tufted. The general colour is fawn, but this varies considerably with age.

Elanet, a genus of small raptorial birds with five species widely distributed in tropical and sub-tropical regions. They are allied to the kites, but differ chiefly in having the tarsus partially feathered. Their diet is, for the most part, insectivorous, but small birds and reptiles are often taken.

Elaps. [CORAL SNAKE.]

Elasmobranchii. [CARTILAGINOUS FISHES.]

Elasticity is that property of most strained substances by which they may recover their original shape and size when those forces which produce the strain are removed. There are different kinds of strain, such as strain in *shape*, *bulk*, or in *length*, and consequently different kinds of elasticity. Thus, a substance may be changed in shape without having its volume altered; if it possess an elasticity that will bring it back to its original shape when the stress is removed, it is said to possess *rigidity* or *elasticity of form*. The characteristic of a fluid is that it possesses no rigidity; any small force may in course of time deform it, and a removal of that force will not necessarily lead to a renewal of the original form. Then a substance may be changed in volume by the application of stress. A sphere of gas, for example, may be compressed into a smaller sphere. If the original conditions of force be obtained, the gas will recover its former size; and it is said to have an *elasticity of bulk* [BOYLE'S LAW], a property that is possessed by nearly all solids, liquids, and gases to a greater or less extent. If a stress be applied in one direction only to a substance, as when a weight is hung at one end of a steel wire that is supported at the other end, change of dimension in that direction will take place; the wire will be extended. Removal of the weight will cause a more or less complete return to the original length. This is due to an *elasticity of length*, and it may be studied without regard to the change in the lateral dimensions of the wire or other material so strained. As a matter of fact, the wire will increase in bulk slightly, though it contracts a little laterally. In all cases of solids an excessive strain will so alter the substance that it cannot return to its original shape and size. Thus, copper wire may be permanently extended if the applied forces are sufficiently large. The material is then said to have a *permanent set*, or to have been stressed beyond the elastic limit. An elastic limit cannot be fixed for a fluid. The numerical measure of elasticity is given by a *modulus* for each material, i.e. the quotient of stress divided by strain. *Stress* is generally measured in pounds per square inch, and *strain* as the ratio of the change in dimension to the original dimension itself. Thus, if a length L is extended to $L + l$, the strain is $l \div L$. Hooke's law states that up to the elastic limit stress is proportional to the strain it produces. The following are the average moduli of elasticity of length and of rigidity for the more important materials employed in engineering, together with their elastic strengths in tension. All are in pounds per square inch:—

Material.	Elasticity.	Rigidity.	Elastic Strength.
Cast-iron ..	15,000,000	6,500,000	10,500
Wrought-iron ..	29,000,000	10,500,000	24,000
Steel, untempered	30,000,000	11,000,000	60,000
Copper ..	30,000,000	13,000,000	190,000
Oak ..	1,500,000	82,000	—

If inelastic bodies impact directly on each other, they will remain together without rebounding. Elastic bodies, on the other hand, exert a mutual force of restitution when they collide and this produces a separation. [IMPACT.]

Elastic Tissue. [CONNECTIVE TISSUE.]

Elateridæ. [FIREFLIES, WIREWORMS.]

Elaterite, elastic bitumen or mineral caoutchouc (CH_2), sometimes containing oxygen, is a soft, flexible substance, with resinous lustre, strongly bituminous odour, blackish, yellowish-brown, or reddish colour, and specific gravity of .8 to 1.2. It occurs at Castleton, Derbyshire; near Edinburgh; Montrelais, near Nantes; Neufchâtel, Switzerland; Zante; Woodbury, Connecticut; and elsewhere.

Elaterium, the dried precipitate from the juice of the pulp surrounding the seeds of the squirting cucumber (*Ecballium elaterium*). This plant is a native of South Europe, but is cultivated at Hitchin, Market Deeping, Mitcham, and elsewhere in England. It is a prostrate annual without tendrils, and produces a small elliptical gourd, which when ripe separates violently from its stalk, ejecting its brown seeds and the pulp surrounding them. To prepare the drug, the fruit is sliced and pressed, and the juice is filtered. It is made into light, thin, friable, greenish cakes, bitter in taste and tea-like in smell, and is imported from Malta in boxes containing from 50 to 120 ozs. This is often, however, adulterated with starch, that prepared in England being better. The official preparation of this drug is the compound elaterium powder, *pulvis elaterini compositus*, dose $\frac{1}{2}$ gr. to 5 grs. It acts as a powerful hydragogue purgative, and should only be administered under medical advice.

Elaters, the name both of fusiform cells in the spore-capsules of certain liverworts (q.v.), with spiral wall-thickening, which assist in the scattering of the spores; and of the four spirally-coiled bands with rounded ends formed by the splitting of an outer coat of the spore in the horse-tails (q.v.). These latter are attached at one point to the spore and coil hygroscopically, thus serving to keep together the spores in small groups, as they escape from the sporangium.

Elba (formerly *Æthalia* or *Ibra*), an Italian island in the Mediterranean, separated from the mainland by the Piombino channel. It is 7 miles from Italy, and 30 from Corsica. The isle is mountainous, the greatest height being about 13,000 feet. The forts of Porto-Ferrajo and Porto Longone are fortified and garrisoned. There are no rivers, but plenty of springs. The climate is good and the land fertile, but agriculture is neglected. Many of the inhabitants are engaged in the sardine and tunny fisheries. There is good iron, and the mines were much worked in the time of the Romans. Silver, marble, granite, and salt are also produced, and there is good fruit and wine. By the Treaty of Amiens (1802) Elba was incorporated in France, and in 1814 the sovereignty was given to Napoleon, who remained there nine months. Vernumth and a particular liqueur are manufactured.

Elbe, THE, one of the chief rivers of Germany,

takes its rise in the junction in Bohemia of several streams from the Riesengebirge, the two final branches being the Weisswasser and the Elbebach. It first flows S., with a swift current, through a wild, rocky valley, widens between Josephstadt and Nimburg, again narrows and passes through a valley between the Lausitzer gebirge, and the Erz gebirge, enters Saxony, and finally takes a N.W. course into the North Sea separating Hanover from Mecklenburg, Lauenburg, Hamburg, and Holstein. Above Hamburg the stream is divided by several islands, but unites five miles above the town. The estuary at Cuxhaven is impeded by sand-banks, but of the course of 780 miles, 470 are navigable. The Upper Elbe basin is mountainous, but the lower basin is flat and sandy, and abounds in morasses and lakes. Salmon, eels, and sturgeon are plentiful. The chief tributaries of the Elbe are the Iser, Black Elster, and Havel on the right bank, the Moldau and Saale on the left bank.

Elberfeld, a Prussian town in the government of Düsseldorf, and about 20 miles E. of the town of that name. It is situated on the banks of the Wupper, and is in a valley enclosed by hills. It forms a continuous town for almost six miles with Barmen, and is the great centre of the cotton trade of the Rhine provinces. It rose into importance from the blockade which followed upon the French Revolution, and its coal and many streams gave facilities for the manufactures then established. There is much spinning and weaving, and manufacture of silk, velvet, cotton, ribbon, nankin, lace, and embroidery. It supplies Glasgow with much Turkey red dye. There are no very important buildings, but the town hall has some frescoes.

Elbing, a Prussian town upon the river of the same name, near its entrance into the Frische Haff, 32 miles S.E. of Dantzic. The river is connected with the Vistula by the Kraffohl Canal, and the harbour has a good mole of over 3,000 yards in length. There are ship-building yards, and manufactures of cloth, leather, and tobacco, among other things.

Elbœuf, a Norman manufacturing town in the department of Seine-Inférieure, about 12 miles S.W. of Rouen, on the left bank of the Seine. There is a good suspension bridge to the village of St. Aubin. Its industries date from long back, and Napoleon spoke of it as a "hive where everyone works." It has steam communication with Paris, Rouen, and Havre, and is one of the chief centres of the French woollen manufacture, which is carried on here in all its branches. There are two Gothic churches—St. Stephen's and St. John's, the former of which has some good old glass.

Elburz, the highest summit of the Caucasus, in lat. 43° 21' N., and long. 40° 5' E., about 140 miles N.W. of Tiflis, is situated on a high plateau. Elburz itself is over 18,000 feet high and is of volcanic origin, and is easy of access.

Elche, a Spanish town in the province of

Alicante, about 15 miles S.W. of the town of Alicante, and near the left bank of the Vinalapo. The town was anciently called Allici, and there are many Roman remains. There is a fine church, a town hall, and a feudal castle, and the general appearance of the town is Moorish. It is approached by a fine bridge.

Elder (*Sambucus nigra*), a common British tree of small size belonging to the order *Caprifoliaceæ*. It produces stout subangular shoots with copious pith, which is used in electrical apparatus and in section-cutting in the biological laboratory. Its leaves are opposite and pinnate, and are used to give a green colour to oil and unguents. The flowers are small, but form corymbose cymes a foot across, with five main branches, each flower having a five-lobed corolla, five stamens, and three carpels. They contain a volatile oil, from which elder-flower water, used as a lotion or perfume and in confectionery, is distilled. The globular, purplish-black berries are used in British wine, and, it is said, as an adulterant of port. The elder wood is white and hard, and is used by shoemakers and turners. Much legendary lore attaches to the tree, Judas being said to have hanged himself on an elder and the cross to have been made from the same species.

Elder, as the name implies, a man of certain age, who in consequence of his age is supposed to possess wisdom as a result of his experience. The senators of Rome were originally supposed to answer this description. Among the Jews, Moses took seventy elders to aid him in the government; so in some modern churches, especially in the Presbyterian, elders are elected to aid the pastors in matters of church management and discipline.

Eldon, JOHN SCOTT, EARL OF (1751-1838), an English Lord Chancellor, born at Newcastle-on-Tyne, where his father was a coal merchant. He was educated—as was his brother William, afterwards Lord Stowell (q.v.)—at Newcastle grammar school and at University College, Oxford, where he obtained an English Essay prize and a fellowship, which latter, however, he had to give up at the end of his year of grace owing to his marriage with Bessie Surtees, with whom he eloped. The friends on both sides forgave them, and came to their aid; but Scott had a hard struggle with poverty both before making up his mind for the bar and during the early part of his legal career. In 1776 he was called, and in 1780 made a name. In 1782 he was K.C., and the next year he entered Parliament and supported Pitt, who made him Solicitor-General in 1788. In 1793 Sir John Scott was made Attorney-General, and six years after Chief Justice of the Common Pleas and Baron Eldon. In 1801 he was Lord Chancellor, and in 1807 he again held the office, which he retained for ten years, through all the difficulties caused by the madness of George III., being created earl in 1821. He resigned at the appointment of the Canning Ministry. He has had many traducers, who have ridiculed his ready tears in presence of his royal master, and questioned his political honesty. He

was a sound and able lawyer, though his slowness in coming to a decision led to a block in his court and to much suffering and injustice. He himself tells us how, when travelling up as a young man from the North, he adopted the motto "*Sat cito, si sat bene*," and had misgivings as to whether he ought not often to have reversed the principle. His delays are said to have been the chief motive in determining Dickens to write *Bleak House*.

El Dorado (the land of gold), a supposed region of America in which gold and jewels were as common as stones and pebbles. It was to the adventurers and explorers of the infancy of colonisation what the philosopher's stone and the elixir of life was to the alchemists of the same period. "Aim at a vesture of gold and you may get a sleeve," says the old proverb, and searches after El Dorado resulted in the acquisition of some of our most valuable colonies. It was Orellana, the companion of Pizarro, that first set the stone rolling in this direction, and it is not impossible that he had some groundwork for his ideas in rumours of that Central American civilisation whose remains form one of the puzzles of the present day.

Eleatic School, a school of Greek philosophy which took its name from the town Elea, in Magna Græcia—the Greek settlement in Southern Italy—of which place the three chief Eleatic philosophers—Parmenides, Zeno, and Leucippus, were natives. The school was founded, according to tradition, by Xenophanes, who came to Elea from Greece. Their method was synthetic as opposed to the analytic Ionian system. Instead of searching for a unity of principle in the varying phenomena of life, the Eleatics started with the idea that the one or absolute alone is real, and in their later development denied that existence can be truly predicated of variety.

Elecampane (*Inula Helenium*), a perennial composite plant, native of Western Asia and Southern and Central Europe, occurred as an escape in England. Its stem is from three to five feet high, and its heads of yellow florets are two inches across. The root, the *radix inula* of pharmacy, is thick, branched, mucilaginous, aromatic, and bitter, with a camphor-like smell. Besides *inulin* (q.v.), an isomer of starch, it contains two crystallisable substances, *helenin* ($C_8H_8O_6$) and *alant-camphor* ($C_{10}H_{16}O$). It was formerly used as a medicine, and, when preserved in sugar as a condiment, being an aromatic tonic thought good for coughs, stitch, etc. It is now mainly used in the manufacture of absinthe and in veterinary medicine.

Election, the choosing any one or more for an office out of other competitors. The doctrine of election is founded on the civil law, and is the duty imposed upon any one or more to select between two alternative claims in cases where it is clearly intended that he or they should not have both. The person who takes his selection of one, but cannot enjoy both.

Electra (*Laodice* in Homer) was the daughter

of Agamemnon and Clytemnestra, and sister of Iphigenia and Orestes. After her father's murder, she sent her brother to Strophius, king of Phocis, and urged him against Clytemnestra and her lover Ægistheus. Orestes and his friend Pylades afterwards took vengeance for the death of Agamemnon. The story has formed a theme for Æschylus, Sophocles, and Euripides, and for modern dramas and operas.

Electric Bells are those that are set ringing by means of an electric current. The ordinary type of *trembler-bell* now so generally adopted in houses consists of a small electro-magnet that will attract an iron keeper whenever a current is passed round the coils of the magnet. The keeper is so placed that when it is attracted the electric circuit is broken, the current stopped, and the keeper pulled back by a spring. As soon as it is so pulled back the circuit is closed, and the current flows round the magnet, only to be broken when the keeper is drawn up. Thus an intermittent current flows round the coils, and the keeper oscillates backwards and forwards so long as the battery is kept in circuit. The keeper is attached to the hammer of the bell, and its oscillation causes a series of taps. The battery is put in circuit usually by pressing a small button which by joining two wires connects the battery with the bell. Usually Leclanché cells are used for these bells, for they last very well, and supply a powerful electromotive force if used only occasionally. Electric bells adapt themselves readily as alarms. There are electric fire-alarms, for instance, which start ringing when the temperature of the protected region becomes high. This ringing is effected by an electric circuit being completed at that juncture; two wires may remain separate so long as they are cool, but any undue expansion by heat may cause them to touch each other, and so close an electric circuit. The same principle of forming an electric circuit is used for burglar-alarms and similar contrivances.

Electric Clocks are those whose motive-power is supplied by electricity. The pendulum may be acted on by an electro-magnet so arranged that it pulls the pendulum first one way and then the other; no weight or spring is then required. Or the weight may be lifted up periodically by an electric current, thus rendering the clock self-winding. A very useful application of electricity to clocks is the rendering of a number of them perfectly synchronous. If a series of similar clocks with pendulums of equal length be worked by the same current, they can be made to tick simultaneously, and so record the same time always. Such an arrangement is specially useful on railways.

Electric Fishes are those furnished with peculiar muscular organs, capable of accumulating electricity and communicating it in the form of shocks to other animals, for the purpose of killing or stunning their prey, or as a means of defence against the attacks of their enemies. Professor

Huxley describes these organs as being always composed of nearly parallel partitions of connective tissue, enclosing small chambers containing cellular structures termed the electrical plates, in one face of which the final branches of the nerves that supply the organ are distributed. The face on which the nerves ramify, when the discharge takes place, is always negative to the other. This surface is inferior in the Electric Rays (*Torpedo*), and the shock passes from below upwards; it is anterior in the Electric Cat-Fish (*Malapterurus*), and posterior in the Electric Eel (*Gymnotus*), and in the former fish the shock passes from the head towards the tail, and in the latter in a contrary direction. These organs may be traced in an ascending series from those in the Common Rays and in the Nilotic genera *Mormyrus* and *Gymnarchus* (where they are without electrical functions, but evidently representing a transitional condition from muscular substance to electrical activity), through the Electric Cat-Fish and the Electric Rays to their highest development in the Electric Eel, a shock from which is said to stun a man. But in all cases the force of a shock depends upon the state of the organ, and if any electrical fish be stimulated to give a succession of shocks these will diminish in intensity till the organ becomes quite exhausted, and will not respond to the stimulus of the nerves. [GYMNOTUS, MALAPTERURUS, TORPEDO.]

Electricity (from the Greek *elektron*, amber, that material being the first employed to illustrate electrical effects). 1. When two dissimilar substances are separated that have been in close contact with each other, each is for a time in a peculiar condition. They are said to be electrified, and in this condition they possess properties that they do not possess ordinarily. Thus when a stick of sealing-wax is rubbed vigorously with a piece of cat's-fur or other similar substance, it is found to be capable of attracting small shreds of paper or other light material. Usually no similar property is noticed in the fur, the electrified state being more transient; but that such does exist in the fur also is shown by mounting it on a wooden disc with a glass handle, and holding the handle during the process of rubbing without touching the fur. The fur will then be seen to attract the shreds of paper in just the same way as the sealing-wax. If suitable precautions be taken, and if the observations be sufficiently close, the law will be found general that separation of different substances is attended with the peculiar state of things above mentioned. The magnitude of these effects does not represent the amount of rubbing of the two materials, but the intimacy of their contact. The electrified condition of the wax or fur may be shared with another body by putting either of them in contact with it. A small pith ball supported by a silk thread may be electrified by simply touching it with rubbed sealing-wax, or with the mounted disc of fur. This being the case it may be shown experimentally that the electrifications of the wax or of the fur are not identical; they may be regarded as opposite. If two pith balls be electrified by contact with the same sealing-wax, they will be

found to repel each other when brought near together. If, however, the second be electrified by contact with fur, it will attract the first. These facts lead to the conclusion that the two bodies separated from each other become oppositely electrified, that similarly electrified bodies repel each other, and those dissimilarly electrified attract. The electrification of the sealing-wax is called *positive* (+), and that of the fur *negative* (-). All electrification is positive or negative, and its identity may be established by testing its attraction or repulsion of a known electrification.

It was stated that the electrified condition could be transferred from one body to another by contact. This transfer is known as *conduction*, and it is found that different substances possess in different degrees the power of conduction. All may be classified as conductors or non-conductors, though there is no sharp line separating the two sets. A very bad conductor is called an *insulator* or *dielectric*. It is because sealing-wax is an insulator that its electrification persists for some time, and conversely it is because the fur is a fairly good conductor that the electrification is rapidly conducted away, unless an insulating handle of glass be employed to keep the fur electrified.

If an insulated electrified conductor be brought near a conductor that is not electrified, the latter will be found to have an electrification induced in it without contact with the first. On the side of the second body nearest the first an opposite electrification manifests itself, and on the side more remote an electrification exists like that which exists on the first. If the second body be touched with the finger, the like electrification disappears, being neutralised by conduction, and there remains on the body a balance of electrification opposite in kind to that of the first. This process of electrifying is called *induction*.

It is convenient in many ways to regard an electrified body as being possessed of something more or less than it possessed before; that electrification means an introduction or withdrawal of this new substance, or a splitting of it up into constituents, which together neutralise each other and are unobserved, but which, separate, exhibit opposite properties. This hypothetical substance is called *electricity*; the two above assumptions are known as the one-fluid and the two-fluid theories respectively. It has not been proved that any such substance exists; experiment readily demonstrates the electrified condition, but does not show whether it is due to a new substance, or to a special state of the particles of the body and of the ether pervading it, or to a modification of the ether which might act as a new substance. In any case, it is unsatisfactory to speak of electricity as having a definite existence. Whereas many analogies exist between electrical actions and the actions of a fluid, by which several of the important truths concerning the former may be more readily grasped, these analogies cannot be carried beyond a certain point without causing gross misconception. Several of the old terms employed in this subject are still used, but with slightly different definitions.

Quantity of electricity, for example, must now be understood as the amount of positive or negative electrification that is able to exhibit electric effects. This may also be called a *charge* of electricity.

With this notion of electric quantity, certain quantitative laws may be introduced. The addition of two equal electrifications gives double that of either, so that if a convenient unit be chosen, electric quantities may be expressed numerically and may be added together. The law already stated, that two bodies similarly electrified repel each other, does not state the intensity of the repulsive force. By an instrument known as Coulomb's torsion balance it was found that two quantities of electrification q_1 and q_2 , in two small bottles whose distance apart was d , caused a force proportional to $q_1 q_2 + d^2$, repulsive when q_1 and q_2 were like, attractive when they were unlike. Thus if either quantity were doubled the force would be doubled; if their distance apart were doubled, the force would be only one quarter of its original value. This law resembles that of magnetic and that of gravitational attraction. By means of it, instruments may be made to measure intensity of electrification by measuring forces, or to compare quantities by comparing the forces that they exert on the same quantity placed at the same distance from each. All such instruments are known as *electrometers*; the best known of these is the Thomson Quadrant Electrometer. Those instruments that only exhibit electrification effects are called *electroscopes*, of which the most familiar is the gold-leaf electroscope. This consists of two equal rectangular strips of gold-leaf hanging side by side within a glass bottle. They are kept close together at the top, but are free to separate and open out at their lower ends; they are best supported from an insulating bridge of glass rod, and from them passes a metal wire upwards through a small hole in the stopper of the bottle. The bottle should be coated with strips of tinfoil all connected together and to the wooden base of the instrument. The wire is terminated outside the bottle by a knob of brass or other conducting substance. When electrification is given to the knob by contact, conduction gives a portion of the charge to each of the gold leaves, which are therefore possessed of like electrifications and repel each other. That they should do so is seen also in another way; an induced charge of opposite kind is produced on the inner surface of the tinfoil coating, and the gold leaves are attracted towards the sides of the vessel by an electrification opposite to their own. The distance apart of the leaves is a rough measure of the intensity of electrification.

That the force of attraction is inversely as the square of the distance is proved by experiment and mathematics in a much more refined way. It is found that a charged hollow sphere exerts no force at any point within itself; this is proved mathematically to be possible only when the law of force is as stated above. It becomes, therefore, impossible to charge a body by placing it inside an electrified conductor; and it also follows that the electrification of a conductor must tend to be confined to the outside surface.

The unit amount of electrification is such that it exerts a repulsive force of one *dynes* (q.v.) on the same amount placed at one centimetre distance. Such is the electrostatic unit; other more convenient units exist, the ratio between which must have definite physical meaning. [DIMENSIONS.]

If one positively charged body be brought near another, force must be exerted to overcome their repulsion of each other. Work must be done to produce this motion against resistance, and energy is therefore expended. The first body can recover its former position if constraint be removed, and in doing so it develops a certain amount of motion; the production of motion always signifies gain of kinetic energy, so that in its new position the body possesses an amount of energy of position that may be converted into kinetic energy if motion be permitted. This energy of position is called *potential*. The potential at any point is measured by the amount of work that must be expended on a body possessed with unit electrification, in bringing it from a region out of range of electric force up to the given point. Two points are at a different potential, when work must be done in bringing the body from one to the other; the body will perform the reverse route without a supply of energy, and give out energy in so doing. That point is at the higher potential, from which the body, if positively electrified, will pass when constraint is removed. If no difference of potential exists along a line joining two points, no force will be required to carry the electrified body from one to the other. To remove the constraint that prevents the passage of electrification from one point to another, a conductor may be made to connect them. Any difference of potential (D.P.) that may have existed will be removed, unless repeated supplies of electrification are presented at those points immediately after each neutralisation of potential. The action that goes on then in the conductor is called an electric current; and the analogy of a current of water may here be introduced. If two quantities of water at different pressures are connected by a conducting channel, the pressures at the two points will be quickly equalised, and the water "find its own level." But in the case of a river we know that two points a mile apart are not at the same level. Does not the water follow the same law? The answer is simply that the water is continually flowing in order to equalise the level at the two points, but that a fresh supply of water is being continually introduced at the higher level. If the supply were stopped, the level would be rapidly equalised.

All the points on the surface of a charged conductor are connected with each other by that conductor; hence, they are all at the same potential, even though the amount of electrification on one portion may be different to that on another equal portion elsewhere. Suppose then a spherical conductor be charged, and let its charge be uniformly distributed, as it will be if it is removed from the neighbourhood of other conductors. Points equally distant from the centre will obviously be at the same potential. These points lie on the surface of a sphere concentric with the conductor, and

determine what is called an equipotential surface, or surface of equal potential for all its points. No force is required to move an electrified body along such a surface. All such concentric spheres are equipotential surfaces, their potential becoming greater as the spheres are taken nearer the surface of the conductor itself. The introduction of any conductor to the neighbourhood must necessarily distort the equipotential surfaces, for the surface of the conductor itself is equipotential. Thus, in nearly all practical cases such surfaces are very complex. Nevertheless, they can never cut each other, for if they did their lines of intersection would belong to both and would be at two potentials at the same time, which is impossible.

The direction of motion of the small electrified body that is free to pass from one point to another at a different potential is along a definite line. This line shows the direction of the force at every point along the route, and is called a *line of force*. In the case of the charged sphere the lines of force are all radial, passing at right angles through each equipotential surface. They are always at right angles, however irregular the surfaces may be. The lines of force in electricity are identical in theory with those in magnetism or in gravitation, and need not be described in detail here. [DYNAMO-ELECTRIC MACHINERY.]

If an insulated plate be positively electrified and brought near an uninsulated plate, an induced negative charge will appear on the latter, and will remain until the positive charge be removed. Though the induced electrification may not be always observable, it is shown that any charge will induce an equal but opposite charge on its surrounding conductors, however remote they may be. Thus, if the tinfoil coating of the gold-leaf electroscope be removed, the charge on the leaves and the metal knob will induce an equal and opposite charge distributed over the walls of the room in which the instrument is placed. When the electroscope is discharged, the induced electrification also disappears. The arrangement of two conductors separated by a dielectric is called a *condenser*; thus, the electroscope and the walls of the room, separated by air, form a condenser. The second conductor is invariably uninsulated. The nearer they are together the less their difference of potential, for their tendency is to unite, and it has been shown that to help this tendency is to help an equalisation of potential. But increasing the charge on the one, and thereby increasing the induced charge on the other, raises their difference of potential. The *capacity* of the condenser is measured by the amount of electrification necessary before the two are at unit difference of potential. It depends on the size of the conductors, on their shape and distance apart, and on the separating dielectric. The best-known form of condenser is the Leyden jar (q.v.).

There are many machines that will produce electrification. The best known are the electrophorus, the Holtz, Voss, and Wimshurst machines. They all electrify by induction, and, excepting the first, they are arranged so that the induced charges shall be handed over to increase the inducing

charges till by repeated accumulation the two conductors become so highly electrified that they cannot retain their charges. These either neutralise each other by breaking across the dielectric separating the conductors, or else discharge themselves into the particles of air surrounding them.

It has been stated that two dissimilar substances on separation from contact become oppositely electrified. The work done in separating them is a measure of their difference of potential when separated. It would, therefore, seem as though when in contact they should be at the same potential. Volta found that dissimilar conductors in contact are always at different potentials, the magnitude of their difference depending on the nature of the substances and on their temperature and other physical conditions. The explanation of this is that they are never actually in contact, however closely they may be applied to each other. But suppose that the apposition is of a different nature. Suppose that any pair B and C are capable of combining chemically with each other. There is reason for regarding two substances chemically combined as being more nearly in actual contact than before; it is as though the P.D. between B and C has become much nearer zero.

If any two conductors B and C touch each other, which do not combine chemically, and are joined by a third, A, in contact with each, it might seem as if continuous electrification or current should pass along A, because it is a conductor connecting two regions at different potentials. But Volta found that the P.D.s at each surface of separation in any such circuit were so arranged that no P.D. exists at the two ends of the same conductor; i.e. the sum of the P.D.s from A to B, B to C, and C to A is zero, and no current can flow along A or B or C. In some respects this law may be viewed as a correlative or as an extension of Newton's Third Law of Motion. [DYNAMICS.] But in the event of, say, B and C exhibiting a tendency to combine chemically with each other, the P.D. from B to C becomes zero, and the above law of Volta no longer holds. A potential difference exists in the circuit, and a current flows, representing just so much energy as is set free by the combination of B and C. As to the questions whence comes the current and in what direction does it flow, no satisfactory answers can be given; but it must be repeated that there is no present knowledge of the existence of such a *thing* as electricity, nor, therefore, of any flow. With the water analogy in mind, it may, perhaps, be useful to point out that, whereas the analogy holds when the energy relations are most simply discussed, there seems reason for believing that if flow occurs at all it occurs in both directions at once—a state of things that demands a rather complex water-analogy. In the case of water the energy given out per second is measured by the amount of water displaced per second multiplied by its loss in level. So also in the electrical case, the energy per second is measured by the amount of electrical displacement per second multiplied by the potential difference.

When A is an insulator of considerable thickness the continuous neutralisation of electrification is

rendered impossible, and we have no current flowing. In that case the difference of potential at those points on B and C touched by A will show the available D.P. that tends to produce current in circuit. But A may not be a perfect insulator, and yet offer obstruction to the above action. This is called *resistance* (q.v.) and depends on the material of which A is made. The obstruction is not complete, so that some current will flow. If no resistances were in circuit, the amount of electrification due to the given D.P. would be unlimited; the current would be infinite. But with resistance in circuit, the current is finite, diminishing as the resistances are increased. Work must be done to effect the passage of electrification against that resistance, and the energy requisite is supplied by the chemical action that takes place between B and C; this energy so spent is converted into heat, and the circuit gets warmer. Such an arrangement for supplying energy is called a *battery* (q.v.); a single centre of supply is called a *cell*. It supplies energy at a certain difference of potential depending on the substances that interact; since this D.P. is to send a current through the circuit it is called *electromotive force* or E.M.F., but the term has objections. To take a simple concrete case, A may be a piece of copper wire one end of which is attached to a copper plate, the other end to a zinc rod C, the plate and rod dipping into a dilute solution of sulphuric acid B. Thus the three substances, A, B, and C, are copper, dilute sulphuric acid, and zinc. The last two are capable of combining, and in so doing give out a certain amount of energy at a certain D.P.; this displays itself, in the first instance, in producing an electric current in the circuit; mechanical motion of neighbouring bodies may be induced by the current, but sooner or later the whole fritters down to heat unless special provision be taken to store some of the energy of the electric current in an accumulator.

It is found that lines of force exist in the neighbourhood of an electric current. In the case of a straight wire, for example, the lines are concentric circles at right angles to the axis of the wire. These are lines of magnetic force; any magnet brought near will tend to range its axis along the line of force through its point of suspension. The intensity of the acting force is proportional to the strength of the current and to the length of the wire, to the strength of the magnet-pole and to the inverse square of its distance from the wire. Thus to produce the greatest effective force on the magnet, the wire should be in a coil of great length close to the magnet, and the current should be as large as possible. This magnetic action of a current is the principle of most of the ordinary current-measuring instruments. They are known as *galvanometers*, the ordinary type consisting essentially of a coil or coils of wire arranged in close juxtaposition with a magnetic needle pivoted on a point or supported by a fibre. The needle is acted on by a controlling couple of forces that tend to keep it in the magnetic meridian, and by a deflecting couple due to the current in the neighbouring coils. The resultant of these two couples

is that the needle is deflected, the magnitude of the deflection being to some scale representative of the intensity of the current. The unit of current practically adopted is the *ampère*, variously defined unfortunately, but theoretically based on the electro-dynamic principle previously stated. Certain instruments are so graduated as to give the magnitude of the current direct in amperes; such are termed *ammeters*. The method of accurately graduating such an instrument will be referred to when electrolysis is discussed.

The only electrical unit at present legalised is the unit of resistance. This is the *legal ohm*, and is defined as the resistance offered by 106 centimetres' length of pure mercury at 0° C., its cross-section being 1 square millimetre. But in much the same way as the standard legal metre, the French standard of length, does not coincide with the ten-millionth part of the earth's quadrant by reason of inaccuracy of measurement, although such was the original definition of the same; so the legalised ohm by reason of inaccuracy of measurement does not exactly coincide with the unit that theory defines as the best. Not that scientists have obtained an exact measure of the true unit, any more than surveyors have exactly measured the earth's quadrant, but they have proved the legal ohm to be perceptibly inaccurate.

The ordinary unit of difference of potential, necessarily associated with the unit of work [ERG], is the *volt*. It is such as will, if maintained at two points joined by a conductor of one ohm resistance, send a current of one ampère through that conductor.

An important theorem known as *Ohm's Law* should now be explained. If a constant P.D. of magnitude v be maintained at the extremities of a conductor whose resistance is r , so that a current c flows through it, then it is found by experiment that doubling the resistance halves the current, but that doubling the electromotive force doubles also the current. Or, more generally, the current is proportional to the P.D. and inversely proportional to the resistance. If convenient units be chosen, the law may be expressed in the simple mathematical form $c = v \div r$. The above definition of the volt is so chosen that the ampère, volt, and ohm are thus simply related to each other.

It was explained previously that the power spent in a circuit was measured by the product of current and potential difference. One ampère through one volt P.D. requires a unit of power, termed a *watt*, 746 of which go to the horse-power. This represents the power expended in overcoming the resistance r —the rate at which energy is lost in electric friction. It has its equivalent in heat units; if the number of watts be multiplied by 24, the product gives the amount of heat in calories generated per second. The above shows how energy of electric current may be changed into heat-energy. The reverse process may also be effected directly, this part of the subject being termed *thermo-electricity*. It was explained how a D.P. existed at the surface of contact of any two substances A and B, and it was mentioned also that the D.P. depended, among other things, on the

temperature of the two. Thus, between A and B when cold there is not the same D.P. as between them when hot, one or other supplying a greater difference of potential. Suppose, then, a bar of bismuth be joined at one extremity to one end of a bar of antimony and to the other end at the other extremity, so that they form a circuit, part of which is bismuth and part antimony. When the junctions are both at the same temperature there will be no D.P. available to send a current round the circuit; there will be no more reason for its flowing one way round than the other. But if the one junction be heated to a higher temperature than the other, the D.P.s at the junctions no longer balance; one will prevail over the other, and a current will flow from the bismuth to the antimony at the hotter junction and from antimony to bismuth at the colder. These two substances are specially chosen because they give a greater D.P. per degree rise in temperature than any other pair of simple substances. A pair of such junctions thus acts like a battery in supplying an electromotive force; the E.M.F. is proportionately greater if a number of pairs be taken. It increases if the temperature of the hotter junctions be increased, but a critical point is at last reached beyond which further heating diminishes the E.M.F. If instead of heating one set of junctions in the thermo-electric circuit a current be passed round, reverse heating effects will be produced, viz. that junction, which was the hotter when a current in the same direction was formerly produced, will now become colder, and the other hotter. This is necessary from the principle of conservation of energy.

Another case of reversal introduces the subject of *electrolysis*. The chemical combination of substances possessing some affinity for each other supplies energy that will produce an electric current. Conversely the energy of an electric current may in special cases separate certain of the ingredients in a chemical compound. Certain compounds conduct electricity in much the same way as elements; others can only do so at the expense of their own constitution, they being split up in the process. Such are termed *electrolytes*, and it is with those that this branch of the subject deals. If two platinum plates dip into a beaker containing dilute sulphuric acid, a sufficient difference of potential applied at their terminals will send a current through the cell. Then bubbles of hydrogen will begin to congregate on one plate and oxygen on the other. It is conventional to call the direction of the current that from the oxygen plate to the hydrogen plate within the cell. So hydrogen is deposited on the plate where the current leaves the cell; this plate is called the *kathode*. Oxygen is deposited on the plate where the current enters the cell; that plate is called the *anode*; collectively, the plates are termed *electrodes*. Gases or other materials so produced are termed *ions*; those deposited like hydrogen on the kathode are called *kathions*, those on the anode *anions*. The quantity of each of the above gases produced by this electrolysis shows that water is decomposed into these constituents. Two volumes of hydrogen come off for every volume of oxygen at the same temperature

and pressure. Inasmuch as these two gases unite with explosive force and give out heat in so doing, it is evident that work must be done to separate them. Insufficient P.D. will not effect this; a single Daniell's cell, for example, cannot be employed for that purpose. If the gases so obtained be collected over each electrode, it will be found, if the original battery be removed and a conductor put in its place, that the electrolytic cell itself behaves as a battery, giving a current in the reverse direction. The hydrogen and oxygen gradually recombine again, and the current continues till the gases are all used up. Thus, the cell has been acting as an accumulator of electric energy. This arrangement is known as Grove's Gas Battery, and embodies the principle of the modern secondary battery or accumulator. [BATTERY.]

Another class of electrolytic cells exists, of much importance in electroplating and allied processes. If the electrodes are of copper and the electrolyte a solution of a copper salt, such as copper sulphate, then the passage of an electric current will still cause decomposition of the electrolyte. But the ultimate action is that the anode is continually deprived of particles of copper, and as continually the kathode has copper deposited on it. The latter need not necessarily be of copper; if it is a conductor, it will receive a coating of the metal in solution. For this action the smallest P.D. will suffice, for there is no ultimate tearing asunder of different materials chemically combined. The amount of copper deposited per second is .000325 gramme per ampere, and a corresponding number exists for silver from a silver salt, hydrogen from a hydrogen salt, or any other metal that may be deposited. Such data are of much importance in measuring current accurately; the current may be made to deposit silver or copper electrically; the amount of deposition in a given time is estimated, and the current calculated therefrom.

The more important electrical terms are noted separately, as also are the practical applications of electricity.

2. *Medical*. By the employment of electrical apparatus the physician is able, in the first place, to learn important facts about the condition of the muscles and nerves in certain forms of disease; and, secondly, he is able to mitigate the ill-effects of the mischief which exists and in some instances to cure the disease outright. Since the first introduction of electrical methods into medical treatment much has been learnt, and both in diagnosis and as a therapeutic agent the electric current is of great service. The exaggerated claims which have been set up with regard to this form of treatment have, however, done much to discredit the application of electricity. This is unfortunate, for there are certain forms of disease in which it is of undoubted benefit. At the same time, there can be no doubt that many persons waste time and money in seeking the alleviation of troubles by the employment of means in no way adapted to the end which it is proposed to gain. Two forms of electricity are employed in medicine. Galvanic electricity (the constant current) and Faradic

electricity (the induced current). Static or frictional electricity, too, is sometimes employed, but is of very limited application.

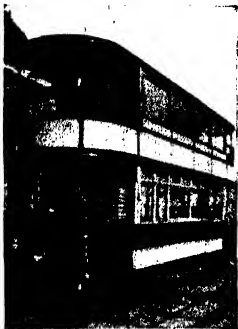
To deal first with electricity as a means of diagnosis. It has been found that, when a nerve is diseased, its irritability when tested by electric currents undergoes certain alterations. By applying the electrodes to the skin over the nerve and noting the reaction of the muscles which the nerve supplies, important facts can be made out. If the nerve is healthy, the muscles readily contract on applying a faradic current; and when the constant current is used, it is found that the contraction is more energetic when the electrodes are applied so that the current passes down the nerve than when it passes up it. If the nerve be diseased, the contraction occurs less readily with both the faradic and constant currents, but faradic irritability diminishes much more rapidly than does the response to the constant current. Again it is found that, when the constant current is employed, if the electrodes be arranged so that the current passes up the nerve, the muscles contract more readily than they do when the current descends and passes down the nerve. These altered phenomena in the contraction of muscles supplied by the diseased nerve are spoken of as the "reaction of degeneration." The importance of these facts is great. In cases of doubt it is possible, by studying the reactions of the muscles to one or the other form of stimulus, to make out whether disease is situated in the nerves or in the muscles.

The employment of electricity as a curative agent opens up a very large field for discussion. In the first place, electric currents are employed to stimulate nerves and muscles. To take, for example, the case of Bell's palsy or paralysis of the muscles of the face due to disease of the facial nerve. Here much good can be brought about by the systematic application of faradism or galvanism, the palsied muscles being stimulated and caused to contract, and so prevented from wasting from mere disuse; while the effect of the currents on the nerve itself is likewise attended with benefit. Speaking generally, faradic currents are employed where the irritability to the induced current is not completely lost, while galvanism is indicated when there is no response to the faradic current. In the second place, electricity may be employed to relieve pain, as in neuralgia, sciatica, and the like. In all instances the strength of current employed needs to be carefully determined. If the object be to produce muscular contraction, the weakest current which will produce that result is usually applied; if it be desired to relieve pain, such a strength of current as is conveniently borne by the patient is, as a rule, quite sufficient, and no greater strength of current should be employed. Other uses of electricity are in the treatment of nævi and the like, where the cauterising action of a strong current is made use of; as a counter-irritant; and in certain hysterical affections.

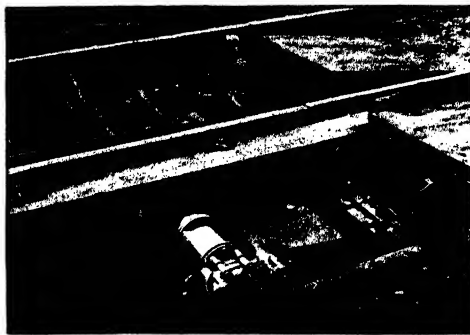
Electric Light at present signifies the production of illumination by heating certain convenient materials to incandescence, an electric

current being employed to effect this heating. When a current passes through a given resistance, heat is generated in quantity proportional to the resistance and to the square of the current. This tends to raise the temperature of the substance at a rate dependent on its specific heat, its emissivity or power of radiation from its surface, its general dimensions, and the external temperature. But if it be a thin rod offering considerable resistance, currents may be sent through it that will, in course of time, so raise its temperature that it becomes incandescent. Of such a nature is the *incandescent lamp*, which consists of a filament of specially prepared carbon or carbonised material coiled in a glass vessel, from which the air has been extracted by a very efficient air-pump. Each end of the carbon is joined to a platinum terminal passing through the glass to the outside. The two terminals are connected up with the leads or wires supplying the current. If the air were allowed to remain in contact with the filament when hot, it would supply oxygen that would immediately combine with the carbon, and the whole filament would be quickly burnt. Platinum terminals are used because that metal has almost exactly the same coefficient of expansion as glass when heated, and will, therefore, expand with the glass without cracking it or becoming loose. In course of about 1,500 hours even a carefully made and steadily worked lamp will burn its filament, and a fresh lamp must then replace it. The life of a lamp is prolonged if a low E.M.F. be used with it; but then the light is less brilliant and more yellow, and its efficiency reckoned in the number of candles per watt or horse-power is not so high. On the other hand, a whiter, more brilliant, and more efficient light can be obtained by using a higher E.M.F., but then its life is shorter. The other type of electric light is that known as the *arc-lamp*. In this case two carbon rods are first brought together, and a current started through them. The resistance at their point of contact is considerable, and they are rapidly brought in that region to a state of incandescence. Moreover, a small quantity of carbon is volatilised, and remains as hot carbon vapour. The rods are then drawn a short distance apart. The current is enabled to flow across because of the carbon-vapour, which, though of high resistance, conducts sufficiently well to prevent a complete falling-off of the current. But its great resistance renders the temperature exceedingly high, and by this means the solid carbon is kept at white heat. The vapour is at a much higher temperature than the solid, but exact estimation of either temperature has not yet been made. The arc light is not kept out of contact with air, and the carbons slowly burn away; various devices have been introduced for automatic regulation of their distance apart.

Both arc and incandescent lamps, since they depend on the production of heat by current flowing against resistance, may be worked by direct or alternating currents. The current may be supplied direct from a dynamo (q.v.), indirectly with a transformer (q.v.), or from accumulators. The object of the transformer is to bring the current



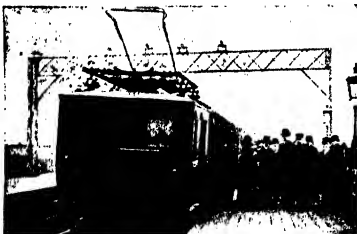
London County Council
(Conduit System) Westinghouse Electric Car.



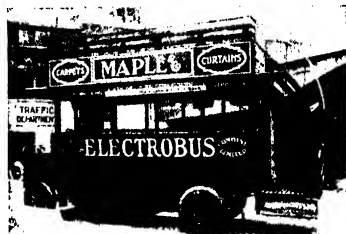
Westinghouse Electro-Pneumatic Signalling System (Great Eastern Railway).



Westinghouse Electro-Pneumatic Signalling System (Great Eastern Railway).



Electric Railway (Single-phase System) between London Bridge and Victoria (London, Brighton and South Coast Railway)



London Electric Omnibus.



Westinghouse Electric Tramway from Cairo to the Pyramids.



Messrs. Robbins, Liverpool phot.
Liverpool Electric Tramways. Trolley system.



Messrs. Robbins, Liverpool, phot.
Liverpool Overhead Electric Railway. Third rail system.

to a suitable condition of strength and potential for the lamps used. Accumulators may be charged by dynamos and then taken off to be worked till they run down again.

There are two general methods of arranging lamps, in *series* and in *parallel*. Lamps in series form a continuous chain, the negative pole of one joining on to the positive pole of the next, and so on. Thus the same current passes through the set; and if by chance one lamp happened to fail, the current would be stopped for the set.

Lamps in parallel are arranged so that all the positive poles are connected up with one bar, and all the negative poles with another bar. These two bars are kept at a constant D.P., which therefore exists for each lamp, and so keeps an equal current going through each. If one lamp fails the others still go on. The greater the number in parallel the less the resistance of the set, so that the total current is actually increased by increasing the number of lamps. But then more power is required for the circuit, and a greater proportion of the whole E.M.F. available goes to overcome the resistance of the generator.

Arc lamps in one system are usually put in series, any danger of the whole set going out when one fails being removed by an automatic device for short-circuiting each lamp if its current fails. This means that when the self-regulating mechanism does not act, the current is allowed to flow from one terminal of the lamp to the other by a different path.

Incandescent lamps are generally in parallel sets, each set being worked from the generator by independent lines, or lines in parallel or in series.

In 1906-8 metallic filament lamps were developed. For the same amount of light, these lamps are said to consume from 50 to 70 per cent. less current than the carbon filament lamp.

But the different methods of arrangement are too numerous to describe in detail. Various installations of different types are continually being laid, the arrangements depending on the amount of lighting to be effected, on the general position of each centre of lighting, and also on the method employed to generate the currents. Distribution of electricity by means of transformers, high potential being used in the conveyance of the currents from the distant source, with conversion to low potential before use, has been effected on a fairly large scale in many places. This plan has been adopted by the Electric Supply Corporation, which has a central station situated at Deptford, in London.

The theoretical defect in these modern systems of electric lighting, or indeed of any artificial lighting, is that so much power is wasted in the production of a large proportion of dark radiation. An arc lamp certainly gives out waves of such frequencies as will produce the sensation of light; but it also gives out an immense amount of dark heat waves, which are practically useless from the light-giving point of view. The light from a glow-worm is far more efficient than that from an arc lamp, measuring efficiency as the ratio of the energy of light-giving waves to the total energy supplied. What is required, then, is to give to a material just

those vibrations that will cause it to incandesce, and no more; the possibility of so doing has been pointed out by J. J. Thomson, Crookes, and Herts. who have separately worked at electro-magnetic radiation. [LIGHT.]

Electric Railway is such that trains thereon are supplied with electric current as motive power. Since 1879, when Werner Siemens opened an exhibition line at Berlin, on which a train of three carriages carrying twenty people was driven by a stationary dynamo at a speed of seven miles an hour, the subject has received much attention at the hands of electrical engineers, and various plans have been devised and tested practically. The train carries some form of electric motor, which will produce mechanical motion if a proper electric current at a suitable potential be supplied. [DYNAMO.] There are two ways of so supplying the current; the one from a fixed dynamo or generator to the train by means of conductors, the other by means of charged accumulators carried on the train, which supply electricity for a definite length of time till their charge is exhausted. In the conductor system there must be some arrangement by which two terminals of the motor are kept at a constant D.P. The plan of supplying the rails on which the train runs with electricity at different potentials is not entirely practicable, because of the difficulty of insulating them from the ground. A single raised conductor has been employed successfully, kept at the required potential and supplying this to the moving motor by means of a sliding or rolling contact; the other terminal of the motor is kept at zero potential by contact with the rails. The parallel system is adopted when several cars are to run on the railway at the same time. It means the working of the motor by means of two conductors at different potentials, which are joined across by the motor wherever it may be placed. One of the conductors may be at zero potential. The series system is to use only one conductor, which is divided up into short segments insulated from each other. The terminals of the motor are connected by sliding or rolling contact with points on the conductor sufficiently far apart to stretch from one segment to another. The different segments being kept at different potentials, a D.P. must exist between the terminals of the motor, which may therefore be driven if the D.P. is sufficient. The advantage of this plan is, that while the motor is on one section it may be made to cut off the supply from the one behind, and so prevent too close an approach of another train. A special application of this series system is that of *telpherage* (q.v.), introduced by Fleming Jenkin. In the Glynde telpher-line the conductor is supported in the air, and from it the train hangs. The carriages are small buckets, and are employed for carrying clay. The storage system has many advantages over the other. Much less difficulty presents itself in planning the installation; there is no laying down of conductors along the route, and each train is complete in itself. On the other hand, efficient accumulators are large and heavy, they are subject to damage by jerking, etc., their

dead weight has always to be carried, but the system is adopted in many long-line cases with advantage, though in short lines the conductor system has the preference. Electric railways and trams have been introduced in England to a large extent of recent years. In London the L.B. and S.C. Rly. opened a local electric service in December, 1909, and all the underground "tube" (q.v.) railways use electric traction.

Electric Telegraph. [TELEGRAPHY.]

Electric Welding, a process of welding by aid of an electric current that heats to welding-point the two surfaces that are to be united. Suppose two wrought-iron bars are to be welded end to end, they are each gripped close to the portion that requires heating, and a very large current passed from one grip to the other along the intervening portions of the two wrought-iron bars. These are pressed closely together, but offer such resistance at their imperfect junction that they are rapidly rendered white-hot, and reach that special condition of fluidity that enables them to unite into one piece. [TRANSFORMER, WELDING.]

Electrification, the production of one of the two opposite conditions of a body that by comparison with the condition of rubbed amber (Gk. *Elektron*) are termed electrified. Electrification may be positive or negative. [ELECTRICITY.]

Electro-magnetism. [MAGNETISM.]

Electro-metallurgy is an important art based on electrolysis. A layer of metal may be deposited on a plate of any shape if this plate be in a suitable solution of the metallic salt, and if a current be passed from a rod or slab of the metal through the liquid to the plate. If the layer is to remain permanently, the process is termed *electroplating*; if it is to be taken off, retaining, of course, any impression that is made on its inner surface by any pattern previously cut on the plate, the process is termed *electrotyping*. The process of electroplating strictly applies to the deposition of silver only, but gold, platinum, copper, and other metals may also be deposited. Silver will not adhere to all metals; iron, for instance, in order to be plated, must first be coated with copper, and this with silver. The surfaces to be coated require first very careful cleansing in boiling caustic potash and then in dilute nitric acid; they are then scoured with sand. The solution of silver generally used is made up of one part of silver cyanide with 10 of potassium cyanide and 100 of water. This is contained in an earthenware trough in which hang the articles to be plated, all connected by a wire with the negative or zinc pole of the battery or dynamo employed. The positive pole is connected with a silver plate immersed in the solution, and the current in flowing through the cell removes silver from the plate and deposits a layer on the given articles. The success of the plating depends largely on the strength of current and of the solution, and on the shape and size of the electrode. When the silver is of sufficient thickness, the articles are taken out of the

plating-bath; they are polished with a rotating wire brush, and then a finish is given by burnishing. Electrotyping is of great importance in many directions, for by means of it copies of woodcuts, printing type, engraved plates, medals, etc., may be taken in metal and rendered practically permanent. There are two methods available to obtain copies of, say, a woodcut. Either an impression may be taken in wax, guttapercha, or some other soft substance that will retain a clear impression; this is then made electrically conducting by being brushed over with plumbago, and hung in the plating-bath as in the electroplating process. Or the original woodcut may be itself hung in the bath, and a layer of copper deposited over it. In the former case an exact copy is at once obtained, in the latter a reversal is first produced, which may easily be removed from the woodcut and then itself used to receive a fresh layer of copper. This will be an exact copy of the woodcut.

Electromotive Force (E.M.F.) means the difference of condition that exists between two regions connected by a conductor, whereby a continuous neutralisation of electrification of opposite kinds is set up. The difference is one of potential between the regions, and is so measured. [ELECTRICITY.]

Electron, a name first used by Dr. Johnstone Stoney to denote one of the infinitely small corpuscles that go to make up an atom, which was thought until quite recently to be the smallest particle of an element, and indivisible. Every atom consists of a particular kind of combination of these electrons with each other, and in a single atom thousands—perhaps hundreds of thousands—are in a state of continual activity. It is also held that electrons may pass from one atom to another, and that the radio-activity of radium is to be explained by this movement of its electrons. Without the intervention of electrons, the transport of electricity would be impossible, and it is through their agency that charged bodies revert to a normal condition. By their power of ionising the surrounding air, ultra-violet light, cathodic rays, and Röntgen rays exercise their characteristic discharging functions.

Electrophorus, an induction machine, composed of an ebonite or resin plate, upon which a circular disc of brass or other metal may be placed by means of a glass handle. When the non-conducting plate is rubbed with fur, it becomes negatively electrified, and this negative charge remains on the surface for some time. The metal plate is then placed on it, and touched with the finger. Being in close contact with a negative charge, which cannot, however, be conducted away because of the insulation, an opposite charge is induced on the plate, the remaining negative charge on the outside being conducted away when the finger touches it. Then, when the plate is entirely removed, it will possess a residual positive charge.

Electrum, a native alloy of gold and silver containing upwards of one-fifth silver. It is so named by Pliny. It occurs in Sutherland with 21 per cent. silver; but more usually, as in

Transylvania, the Altai and Colombia, with 36 to 38 per cent. Its colour ranges from brass-yellow to yellowish-white, and its specific gravity varies regularly with the silver percentage from 15.5 to 12.5. It crystallises in the cubic system, in forms often more sharply defined than those of native gold.

Elegit, the name of the writ by which, after judgment in an action has been obtained, the sheriff gives the judgment creditor possession of the lands and tenements of the opposite party to be occupied and enjoyed until the money due on such judgment debt is fully paid, and during the time the judgment creditor so holds them he is called tenant by *Elegit*, his estate being a mere conditional one defeasible as soon as the judgment debt is levied. By this writ formerly only one-half of the lands and tenements of judgment debtor could be taken in execution, but a statute passed very early in Victoria's reign for the first time enabled the judgment creditor to seize by that writ the whole of the judgment debtor's lands and tenements.

Elegy (perhaps from Greek *e-e-legein*, to cry Woel woel) originally implied a mournful poem; and then was used to signify a certain poetical measure consisting of couplets of alternate hexameters and pentameters, commonly known as elegiac Coleridge gives an example of it thus:—

"In the hexameter rises the fountain's silvery column;
In the pentameter aye falling in melody back."

It is possible that the connection between elegy and the idea of mournfulness arises from the fact that this metre was a favourite one for funeral inscriptions; but it was used also for joyous poems and for war songs. Everyone knows Gray's *Elegy*, and readers of Hood's comic poems will remember his line—

"And I've been singing his L-E-G."

Element. According to the doctrines of Empedocles and Aristotle there were four elements, earth, air, water, and fire, to which was also subsequently added a fifth, the *quinta essentia*, the ether. It seems probable, however, that these ideas did not originate with the Greek philosophers, but were borrowed from earlier sources, perhaps from the Indians. The term element as used by them, however, did not convey the same meaning as it does at the present time. It then implied a property or complexion, rather than a form, of matter. Thus the properties of cold and moisture were associated with water, cold and dryness with earth, etc. Later, the alchemist Geber supposed all metals consisted of varying quantities of *mercury* and *sulphur*, and for the transmutation of metals what was necessary was but the addition or abstraction of one or other of these substances. Basil Valentine added *salt* as the third elementary substance, which, with the two previous ones, formed all bodies. It appears, however, that this sulphur, etc., were not identical with what we know now by the terms, and were possessed of many more or less mythical properties. Boyle first gave a distinct definition of the term element, stating that those substances are to be considered as elements which are not capable of further separation into simpler components. He

did not, however, specify what substances he considered as elementary. At the present day about 70 simple bodies are recognised by chemists, a list of which is given under **ATOMIC THEORY**. Besides those there given, a few others may be regarded as doubtful, as, for instance, holmium, and masrium, whose existence was only indicated in 1892. Further, it is always possible that some of the substances regarded as elementary may be proved to consist of two or more simple bodies. Thus didymium is very probably not a true element, while the elementary nature of cobalt and nickel is also disputed. The first classification of the elements was that of metals and non-metals, and although it is impossible to draw a definite line of demarcation between these two classes the division is still a convenient one for many purposes. The sole basis, however, upon which a scientific classification can be founded is the Periodic Law (q.v.). Of the elements but few (about 20) are found free in nature, as oxygen, nitrogen, sulphur, carbon, and some metals, while most of these are far more common in combination. Compounds of carbon are known as organic matter. The crust of the earth consists almost entirely of 13 elements only, of which oxygen is the most abundant. What the composition of the interior may be, is, however, still a matter of conjecture. The question whether the various elements are distinct forms of matter or whether they are all various products of evolution from one primordial matter is one that affords great scope for theorising. Until recently the first view was that almost universally accepted, but of late years the second, an evolutionary idea, has been finding favour with many chemists. In the present state of knowledge, however, all theories upon this subject must be regarded as purely speculative. (See also **ATOMIC THEORY**, **CHEMISTRY**, **PERIODIC LAW**, and the articles on the separate elements.)

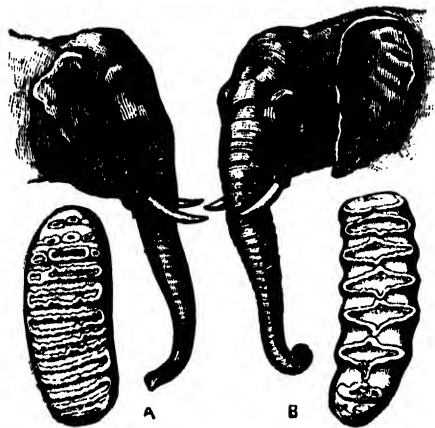
Elemental Spirits, a collective name for the beings formerly supposed to inhabit and rule over earth, air, fire, and water. [**GNOME**, **SALAMANDER**, **SYLPH**, **UNDINE**.]

Elements, in *Astronomy*, are the quantities from which the tables of planetary motions are calculated, such as the period of rotation of the planets about their own axes and their revolution round the sun, the dimensions of their orbits and the gradual movement of these, etc.

Elemi (from the Greek *ēnaimōn*, the name of a styptic gum said by Pliny to exude from the olive-tree of Arabia) is an oleo-resin, or rather a class of oleo-resins, partly crystalline and less soluble in alcohol, and partly amorphous and more so. It is tough, light-yellow, greenish-yellow, or colourless, with a fennel-like smell and aromatic bitter taste. That used in pharmacy is exuded from incisions in *Canarium commune*, a Philippine Island tree, and is known as Manila elemi. Mauritius elemi comes from *Colophonia Mauritiana*; African, from *Boswellia Frereana*, and probably other species native to Somali-land; American or Brazilian, from *Icica Icariba*, *I. heptaphylla*, *I. Caranna*, etc.; and Vera Cruz or Mexican, from *Amyris elemifera*. All these trees belong to the order *Amyridaceae*,

Burseraceæ or *Terebinthaceæ*, as it is variously called. Though used as a constituent of a stimulating ointment and as incense, elemi is chiefly employed in the manufacture of spirit and turpentine varnishes. In the Philippines it is used in caulking ships and in torches.

Elephant. Any individual of either of the two species of *Elephas*, the sole living genus of the order Proboscidea (q.v.). They are the largest of the quadrupeds, extremely massive in build, walking on the tips of the five toes with which each foot is furnished, and on the cushion-like pad which unites them and forms a flat sole behind them. The skull is disproportionately large, but increase of weight is obviated by the large air-spaces, separated by thin bony partitions. The brain is small, scarcely exceeding



ELEPHANTS.
A, Indian (showing molar tooth); B, African (showing molar tooth).

that of a man in size; and though it is greatly convoluted, as might be expected from the intelligence of these animals, the hind brain, or cerebellum, is not covered by the cerebral hemispheres. In this particular, as in some others, the elephants show some affinity to the Rodents. The nose is prolonged to form a flexible proboscis or trunk, divided by a partition into two tubes, the extremities of which are the true external nostrils. This trunk, which in large specimens is about eight feet long, is of the greatest service to these animals, for it is extremely strong and of great sensibility. With it they can lift a cannon, or pick up a pin. It serves to carry food and water to the mouth, and can be converted into a syringe or a shower-bath. Its length compensates these animals for their short, muscular necks absolutely necessary to support the weight of the head and tusks, but too short to allow them to gather the succulent shoots and herbage on which they feed. They have only incisor and molar teeth; the former, popularly known as tusks, grow from persistent pulps, like the incisors of a rabbit or a mouse, and are present in both sexes in the African elephant, while in the Indian species

they are absent or only partially developed in the female. There are no incisors in the lower jaw; and only one molar or at most portions of two, on each side in each jaw at one time. These, however, when worn, are replaced from behind; and in this way six molars above and below on each side are successively brought into use in the animal's lifetime. The skin is extremely thick, and scantily covered with coarse, bristly hair. The gait of the elephant is very different from that of other quadrupeds, and this arises from the fact that the thigh is set so as to form nearly a right angle with the body when the animal is at rest, and not bent up so as to make an acute angle with it, as in the horse and the cow, so that the knee in the elephant is much nearer the ground than it is in these animals. The eyes in both species are very small; but all the senses are highly developed.

Elephants have strong social instincts, and live in family associations or herds of from 20 to 100 individuals in the tropical and sub-tropical regions of the Old World. When on the march the cows and the young go in front, the bulls bringing up the rear, followed by the old bull who is lord of the herd. The males are polygamous, and the strongest either kills his rivals or expels them from the herd. Sometimes, however, old bulls are found singly or in pairs, and occasionally in small herds of from six to twenty. At the breeding season the males are said to be "must," from an Indian word signifying "drunk." They are then the most dangerous of all animals, being subject to wild outbursts of fury, and even in a domesticated condition they are utterly regardless of their keeper, upon whom they often turn in their rage. A "rogue" elephant is one that has been driven from a herd, and in consequence has become savage, cruel, and morose. "He is possessed not by sudden bursts of fury, but by a deliberate, brooding resolve to wage war on everything, and lies patiently in wait for travellers" (*Romanes*). The female is an affectionate mother, and usually bears but one calf at a time, though cases of twins are on record. The period of gestation is 20½ months. The intelligence of these animals is very great, and, according to Professor Romanes, is only inferior to that of the dog and the monkey.

Elephants have been known from remote antiquity. The Greeks had abundance of ivory, and Solomon decorated his throne with it. The Carthaginians employed the African species in war more than 2,000 years ago, while the Indian species was probably utilised in the same way and also as a beast of burden at a still earlier period. They were employed in the pageants and games of the Romans, and they are still used for the same purposes in India.

Although the Indian elephant is still domesticated, and largely used as a beast of draught and burden, the African elephant only exists in the wild state, and it is on account of the ivory it yields that the latter species is so important. Ordinary tusks only average three to the hundredweight, so that immature animals must often be slaughtered. It is said that 15,000 are killed annually for the British market alone, and that the total annual

slaughter is about 75,000, which far exceeds the rate of increase. Indian elephants also furnish their quota, and a little of it is taken from living animals, as it is the custom to cut the tusks of domesticated elephants every ten years.

The Indian Elephant (*Elephas indicus*, the *Elephas indicus* of some authorities) is found all over the wooded parts of the Oriental region, ranging eastwards to the frontiers of China and Sumatra and Borneo, and southward to Ceylon. The males stand about ten feet at the shoulder, and the females about a foot less; the trunk ends on the upper surface in a finger-shaped lobe; and there are four or five of the digits of the hind-foot which are furnished with nails. The difference in the head and ears and in the folds of the enamel of the molars in the two species will be seen by reference to the illustration.

The African Elephant (*Elephas* or *Loxodon africanus*) is said to range the continent south of the Sahara, but it is being driven back slowly but surely to the equatorial forests. The males stand a little over ten feet high at the shoulder, and the females about a foot less. There are only three nails on the hind-foot, and the extremity of the trunk has a small opposable process on the upper and lower surface. [DINOTHERIUM, MAMMOTH, MASTODON.]

Elephanta, an island in the Indian Ocean, in the presidency of Bombay, and 6 miles from the city of Bombay. The island, which received its name from the Portuguese on account of the figure of an elephant cut in the rock, is renowned for its grottoes or underground temples, which are very ancient Indian monuments. The principal of these temples, which are reached by a staircase leading to a terrace, is 130 feet in height, 123 in breadth, and 18 feet high, supported on many pillars of solid rock, and has a figure of the Hindoo Trinity of Brahma, Vishnu, and Siva, the creator, the preserver, and the destroyer. There are other caves carved with mythological subjects.

Elephant Hawk-moth. [HAWK-MOTH.]

Elephantiasis. This term has been applied to diseased conditions in which hypertrophy of the connective tissue of parts of the body leads to swelling. Two special uses of the word may be alluded to; in the first place, *Elephantiasis Græcorum* is used as a synonym for leprosy (q.v.). *Elephantiasis Arabum*, or Barbadoes leg, is a peculiar affection which appears to be brought about by blocking of lymphatic vessels. The disease is confined to tropical countries, and is not uncommon in India; it usually attacks adults, and does not in itself tend to shorten life. By some it has been maintained that the cause of the affection is a parasite.

Elephant Seal (*Macrorhinus elephantinus*), ranging from the Antarctic Ocean to California, though the northern form is sometimes made a distinct species (*M. angustirostris*). It is the largest known seal, and the old males have the snout developed into a kind of proboscis.

Elephant's Ear. [EGONIA.]

Elephant Shrew, a popular name for any species of the insectivorous family Macroscelidæ. They are small African rodents, with a proboscis-like muzzle. They are also called Jumping Shrews, from their kangaroo-like mode of progression.

Eleusis was an important city of ancient Attica, 10 miles N.W. of Athens, near the Saronic gulf, at the east end of a height parallel to the shore. It was the chief seat of the important mysteries connected with the worship of Demeter and Persephone. The town was destroyed by Alaric in 396, and it is now represented by a small village.

Eleut (*Oliut*), a large branch of the Eastern Mongolians occupying the Ala-Shan highlands south of the Gobi desert, and stretching westwards from the Ordos region; said to take their name from Eleutai, a prince of the dynasty founded by Jinghiz Khan. Later this term was extended to the western hordes whose domain reaches from the head waters of the Selenga to the Upper Irtysh basin. They are divided into four sections: Zungar, Turgut, Khoshod, and Turbot, collectively forming the historical Durban-oirad or "Four Allies." Connected with them are also the Western Mongols, known to the Mohammedans as Kalmucks. The Zungar branch is now extinct, or absorbed in the Eleuts of the Ala-Shan Mountains, many of whom were driven thither from Zungaria in 1686 (Prjevasky, *Mongolia*, i. p. 231).

Elevation, in *Astronomy*, is the height of an object reckoned in terms of its angular distance from the horizon. In geometrical and architectural drawing, an elevation means a side view drawn without perspective—an aspect that is only physically correct when the object to be drawn is viewed from a great distance.

Elevators, a word generally used to signify a mechanical contrivance for raising things quickly from one level to a higher one. In America it often implies what in England is called a lift, and may represent anything of the above nature from the tray worked by a rope which raises dishes from an hotel kitchen to the restaurant to the elaborate apparatus which, by hydraulic power, lowers or raises passengers to or from the Mersey Tunnel or the stations of the various London "tube" (q.v.) railways. The name is also applied to contrivances—generally hydraulic—for discharging grain from barges or ships into warehouses, or vice versa. This kind of elevator is much used in the United States and in parts of Europe (Antwerp, for example), and is generally hydraulic. The main parts are a continuous chain carrying buckets, and a travelling band of indiarubber or canvas. The buckets work vertically, and pour the grain upon the travelling band, which conveys it horizontally to the required destination. Another description of elevator consists of a huge double scoop which, as it descends into a bulk of grain, opens wide at the bottom and grasps a certain quantity upon which it closes, and then ascending and turning to the point desired opens again and drops the grain which it had taken up.

Elf, a Teutonic word, generally replaced in modern English by "Fairy" [FAIRIES], and when used alone signifying a sprightly, graceful, but somewhat mischievous child. It retains its original meaning, however, in many compounds; as *elf-arrows*, *-bolts*, *-darts*, *-shots*, *-stones* = flint implements (q.v.), for these were formerly supposed to be weapons used by the fairies against men and cattle; *elf-child* = a changeling (q.v.); *elf-land* = the land of enchantment, fairyland; and *elf-locks* = knots of hair mischievously twisted by elves or fairies, hence applied to hair matted and in disorder.

Elgin. 1. A coast county of Scotland upon the southern shore of the Moray Firth, between the counties of Banff and Nairn on the E. and W. respectively, and having Inverness on the S. The area is 340,000 acres, of which 103,000 are under cultivation. In the south of the county there are hills interspersed with fertile valleys, and there is much forest and heath. The sea-coast is, for the most part, flat, though in the middle of the coast-line of 30 miles there are sandstone cliffs. At each end of the line there are mounds of sand and gravel. There are several lochs, and the rivers Spey, Findhorn, and Lossie have fine scenery and afford good salmon-fishing, while trout abound in the lochs. Granite, felspar, mica, slate, and sandstone are the components of the rocks in the south. There are large quarries of freestone, and some of slate. The climate is mild, and dry, and the lowlands are fertile. The county exports corn, whisky, salmon, and timber, and unites with Nairn to return one member to Parliament. The principal towns are Elgin, Lossiemouth, Forres, and Burghead. Morayshire is a name by which the county is also known. Pop. (1901), 44,570.

2. The capital of the county of Elgin, is a parliamentary borough, uniting with five other towns, called the Elgin Burghs, to send one member to Parliament. It is situated on the Lossie, five miles above Lossiemouth, and 37 miles E. of Inverness, and is on a gentle slope surrounded by wooded hills. The High Street runs for about a mile E. and W., and among the public buildings are several churches, a hospital, museum, market rooms, assembly rooms, and the Elgin Institution. There are only some fragments left of the cathedral, which was founded in 1224, and was the finest in Scotland. The final touch in its ruin was given by the Regent Murray, who stripped the lead from the roof in 1568. There are cloth factories, iron foundries, tanneries, and breweries, and a good trade in farm produce. Pop. (1901), 8,407.

Elgin, JAMES BRUCE, EIGHTH EARL OF (1811-1863), was educated at Eton and Christ Church, Oxford, where he took a first class in classics and a fellowship at Merton College. In 1841 he entered Parliament as member for Southampton, and succeeded in the same year to the earldom. The next year he resigned his seat, and was appointed Governor of Jamaica. In 1846 he became Governor of Canada, and did much towards conciliating the discontented provinces. In 1849 he was made a British peer, with the title of Baron Elgin. In 1857

he was sent on a special mission to China, and, though he sent most of his troops to take part in subduing the Mutiny which had broken out in India, he succeeded the next year in negotiating the treaty of Tientsin. In 1859 he was Postmaster-General in Lord Palmerston's government. He succeeded Lord Canning in the Governor-Generalship of India, and died while on a tour in the northern provinces.

Elgin Marbles, a collection of bas-reliefs and statuary brought to England from the Parthenon of Athens by the seventh Lord Elgin in 1814. They are now in the British Museum, having been bought by the nation. Some question the propriety of their removal from their original site, but there is no question that they are a most valuable collection from an artistic point of view. Many nations possess casts of them, and they have been fully described.

El Haiyât, an Arab tribe of the Haurân uplands south of Damascus, specially remarkable for their extremely fair complexion. M. Rey describes their sheikh as "a man with blond beard like all the people of his territory" (*Voyage dans le Haurân*, p. 71). It is probable that the light colour of these Arabs is due to alliance with the Druzes [Druzes], large numbers of whom removed from the Lebanon to Haurân about the middle of the century.

Elijah, one of the chief of the Hebrew prophets, who lived probably about 800 B.C., and whose special mission was to combat the foreign influence brought to bear by Ahab's Phœnician alliance and marriage with Jezebel. His life is set forth in the Books of the Kings.

Elimination, in *Algebra*, means the operation of removing a quantity from an equation by combining it with another equation. Thus, we may know the area of a circle in terms of its circumference, and also the circumference of a circle in terms of its radius. Combination of these two may be made to give us the area of a circle in terms of its radius, an elimination of the expression for the circumference being effected. Or two equations may exist each involving unknown quantities x and y . They may be so manipulated together that a resultant equation in x or in y only may be obtained by elimination of the other unknown. In astronomy the elimination of errors of observation by means of repetition of the observation in different ways is of much importance.

Eliot, GEORGE, was the pseudonym of MARY ANN EVANS, one of the greatest novelists of the 19th century. She was the youngest daughter of Robert Evans, a Warwickshire land agent, by his second wife. The baptismal Christian name of the future novelist was Mary Ann, but she usually signed herself Marian Evans. Her father was a man of unusual strength of character, and many of his distinctive qualities have been depicted in Adam Bede, the hero of the novel of that name, and in Caleb Garth, one of the most striking individualities in *Middlemarch*. Her mother, whose maiden name was Pearson, was understood to have

been the original of Mrs. Hacket in *Amos Barton*. Miss Evans was born at Arbury Farm, in the parish of Colton, Warwickshire, November 22, 1819. She had a sister and a brother, Christiana and Isaac, the latter being delineated in *The Mill on the Floss*; he also, in all probability, formed the subject of the notable sonnets entitled *Brother and Sister*. In the course of a few months, after Mary Ann's birth, the Evans family moved to Griff Farm. At five years of age Miss Evans was sent to school at Attleboro', where she remained for four years. Then she went to a boarding-school at Nuneaton, where she formed a close friendship with the principal governess, Miss Lewis, with whom she subsequently corresponded. Mrs. Evans died in 1836, and, Christiana Evans having married in the following year, Marian Evans now undertook the charge of her father's house. Masters came over from Coventry to instruct her in German, Italian, and music, and she was also an omnivorous reader of works in general literature. In 1841 Mr. Evans and his daughter removed to Foleshill, near Coventry, where Marian Evans established a firm friendship with Charles Bray, a philosophical writer, and his brother-in-law, Charles Hennell, the author of a rationalistic *Inquiry Concerning the Origin of Christianity*. Her new relationships had a destructive effect upon her religious views. She abandoned evangelicalism for scepticism, and it was with the utmost difficulty that her father persuaded her for a time to conform to the old rules of public worship. For nearly three years she devoted herself to a scholarly and able translation of Strauss's *Leben Jesu*, which was published in 1846 by her friend, Dr. John Chapman. At a later period she translated Spinoza's *Tractatus Theologico-Politicus*, and later still his *Ethics*. Losing her father in 1849, to mitigate the blow she went abroad, and resided with the Brays for some months at Geneva. Returning to London in March, 1850, in September of the following year she became assistant-editor of the *Westminster Review*. About this time she translated Feuerbach's *Essence of Christianity*, the only work to which she appended her real name. Thrown into friendly relations with Herbert Spencer and George Henry Lewes, her intimacy with the latter (who was separated from his wife) grew so rapidly that in 1854 they defied the usages of society by forming a non-legal union, which lasted until the death of Lewes in 1878. That this lamentable step was injurious to George Eliot from many points of view is well known.

When Lewes was contemplating his *Life of Goethe*, he and George Eliot visited Weimar and Berlin. On their return to England they resided successively at Dover, East Sheen, Richmond, and London. Drawn towards imaginative literature as she had been for some years, it was in 1856 that George Eliot made her first attempt at fiction, being urged thereto by Lewes. The appearance in *Blackwood's Magazine* of that pathetic sketch, "The Sad Fortunes of the Rev. Amos Barton"—the first story in *Scenes of Clerical Life*—created the deepest interest in literary circles. The volume of which it forms a part was never surpassed by the

author in skill and delicacy of workmanship. In 1859 appeared *Adam Bede*, the most popular and the most human of George Eliot's larger works of fiction. The success of the novel was almost beyond precedent, but the writer suffered extreme annoyance for some time owing to the unfounded claim of a native of the Midlands, named Liggins, to the authorship. *The Mill on the Floss*, which is marked by tragic scenes and strongly individualised characters, was published in 1860, and *Silas Marner*, one of the most beautiful and idyllic of the author's works, in 1861. The publication of that remarkable story of Italian life, *Romola*, marked a new epoch in George Eliot's literary career. Tito, Romola, and Savonarola are among the greatest of her creations. *Felix Holt*, issued in 1866, was a link between a dying and a coming generation, but, from the artistic, as from other points of view, it was the least successful of the author's works. George Eliot visited France in 1865, and Spain in 1867, and after her return to England she made her first appearance as a poet with *The Spanish Gypsy*. High as she herself ranked this class of effort, her verse lacked spontaneity and fire to rise to the highest poetic level. The form was perfect, but the afflatus was largely absent. *Agatha*, *The Legend of Jubal*, and *Armgart*—further studies in poetry—appeared at intervals. In 1871-72 was published the novel of *Middlemarch*, which signalled the third and crowning epoch of George Eliot's career. This fine study of English provincial life stands to its author in the same relation that *Hamlet* does to Shakespeare. It is distinguished for its literary execution, its philosophy, and its profound studies of character. *Daniel Deronda*, the last of the brilliant series of novels by this gifted writer, appeared in 1876. It was decidedly inferior to *Middlemarch*, though it showed a singular grasp of Jewish sentiment and culture. This eloquent apology for the Jews did full justice to their noble aspirations and their unswerving faith. In 1878 Lewes died, and, after the first bitterness of the separation was over, George Eliot set herself to the task of preparing for publication her last work, *The Impressions of Theophrastus Such*. This volume of miscellaneous essays contained several admirable studies, including one on *Debasing the Moral Currency*; but, as a whole, the work was somewhat hard and laboured. To the surprise of many of her friends, George Eliot married in May, 1880, Mr. John Walter Cross, a gentleman who had known her for twenty years, and whose devotion and sympathy she warmly appreciated during her brief period of widowhood. The new union was destined to be of short duration. After a few months of foreign travel, Mr. and Mrs. Cross returned to England, to a house which they had taken in Cheyne Walk, Chelsea. On the 19th of December, 1880, George Eliot was seized with illness, which soon assumed an alarming character, and the world was startled by the announcement that she had passed away at midnight on December 22. She was buried by the side of Lewes in Highgate Cemetery. In 1883 her essays contributed to the *Westminster Review* were collected and published, and in 1884 Mr. Cross issued her journals and

letters in the form of a biography. George Eliot took a deep interest in the higher education of women and other questions of moment to her sex, but she rarely expressed her views on the public topics of the time. She was passionately enamoured of music, and was constantly to be seen at the popular concerts in St. James's Hall, and she had considerable taste and judgment in art. As to her religion, she had a deep sympathy with Auguste Comte and his system, though she declined to be absolutely bound by the doctrines of Comte or any other religious teacher. Her chief qualities as a novelist were reflectiveness, observation, humour, and pathos. As a story-teller she has been excelled by many of her own sex, but she outdistances them all in culture and intellectual strength. In sheer force and ability she deservedly ranks in close proximity to Scott, Dickens, and Thackeray; and, although it may be doubted whether her popularity will prove as wide as theirs in future generations, she will yet undoubtedly leave a powerful and an indelible impression upon English literature.

Eliot, Sir John (1592-1632), a champion of freedom of speech in Parliament, was born in Cornwall, and educated at Exeter College, Oxford. He entered at one of the Inns of Court, and made the Continental tour, in the course of which he made the acquaintance of Villiers, afterwards Duke of Buckingham. In 1614 he entered Parliament, and, owing to the good offices of Villiers, he was knighted in 1618, and the next year was appointed Vice-Admiral of Devon. In 1623 he got into difficulties with the Court over a question concerning his office, and in 1624 he was in Parliament as member for Newport. The next year saw the end of his friendship with Buckingham. In 1626 he represented St. Germans in Parliament, and, as leader of the House, headed the attack upon Buckingham, and was sent to the Tower for his pains. In 1628 he represented the county of Cornwall, and was a great supporter of the Petition of Right. In 1629, on the memorable occasion when the Speaker was held in the chair, Eliot proposed the resolutions. He was sent to the Tower and fined £2,000. He wrote much in prison, and there he died. He was not a republican in principle, though his fate put him into the forefront of the battle for privilege of Parliament.

Eliot, John (1604-1690), called "the Indian Apostle," and "the Indian Evangelist," was born in Hertfordshire, and educated at Jesus College, Cambridge, where he graduated B.A. in 1622. He taught in a school, and took orders, but owing to difficulties on account of his religious views he went to New England, and was called to a pastorate at Roxbury, which he retained till his death. He took great interest in the welfare and conversion of the Indians, and established what was called the praying colony at Natick. He contended that the civil improvement of the natives must be attended to as well as the religious. He translated the Bible into an Indian tongue, and in 1666 brought out an Indian grammar, besides making many other translations and producing many writings.

Elis, a district in the W. of the Peloponnesus, along the coast, having Arcadia on the E. and Messenia on the S. It was watered by the Alpheus, and the capital was called Elis. In it was Olympia, whose games were so important in the Greek world that the dates were regulated by their recurrence, just as some English sportsmen will speak of such and such a thing happening in *Hermit's* year or in *Gladiator's* year. [OLYMPIAD.]

Elisha, a Hebrew prophet, the successor of Elijah, and the carrier on of Elijah's work in the school of the prophets. He was the moving spirit of patriotism during the wars with Syria. His life is told in the Books of the Kings.

Elixir, an Arabic word originally applied to the philosopher's stone, and later to a drink which was supposed to confer immortality. Latterly the name has been applied to different medicinal drinks or syrups. Most people have heard, if not partaken, of paregoric elixir. The idea of an elixir of life—in a modified sense—is not yet exploded, for quite lately a scientific man put forth the idea of a subcutaneous injection which was supposed to renew vigour and prolong life indefinitely.

Elixir Vitæ was the great elixir, known under the various names of the *great medicine*, the *magisterium*, the philosopher's stone, etc., for which the alchemists of the 13th to the 15th century so ardently searched. The powers ascribed to it were practically unlimited; thus, besides its power of healing all human diseases, it was to convert all metals into gold. Recipes for the preparation of this and other minor elixirs are to be found in various alchemistic writings, but also are so disguised in mystical and symbolic language as to be frequently quite unintelligible.

Elizabetgrad, a Russian town on the Ingul, in the government of Kherson, and 130 miles W. of the town of that name. It is a regularly-built town, with wide streets, in many cases lined with trees. It has suburbs, and a citadel with several bastions, and is the head of the military colonies of that district.

Elizabeth, an American city, capital of Union county in the state of New Jersey, 14 miles S.W. of New York, with which city it has railway and steam communication. It is in a fertile district, and is well-built, and has many churches, schools, a court house, city hall, and other public buildings. There are foundries and oilcloth factories, and a factory of Singer's sewing machines.

Elizabeth (1533-1603), Queen of England, one of the most popular and most remarkable monarchs that England has had. The "man-minded offshoot" of Henry VIII.—"*le Roi Elizabeth*" as the French used to call her—was born at Greenwich, being the daughter of Anne Boleyn. Much of the peculiar nature of her qualities was the natural outcome of the circumstances of her early life. Made much of at one time as a likely heir to the crown, becoming at another an object of jealousy and dislike to her sister Mary, and in no small danger of losing her head, it is not surprising that

a profound power of dissimulation was a marked feature in her character. It was during this period of her life that she developed the circumspection, prudence, and tact that enabled her to become an almost autocratic ruler, and the valuable gift of an unerring judgment in the choice of counsellors. When the death of her sister Mary in 1558 put her upon the throne, she had a difficult course to steer, but thanks to her own wisdom and to that of Cecil, Walsingham, and other like-minded advisers, she evaded all the rocks and shoals in her way. Her dislike to marriage, which has puzzled both her contemporaries and later generations, may have been owing to a combination of causes, one of the chief having, no doubt, been a conviction of ability to rule, and a disinclination to sacrifice any portion of her liberty. Her coquetting and vacillating dealings with the Duke of Alençon may have been partly owing to the dictates of policy, and partly to that womanly weakness that she sometimes showed, and which appeared all the greater by contrast with her usual manlike qualities. It is also to this weakness that we must set down the one great political blunder of her life—her treatment of Mary Stuart. Feminine jealousy seems to have been as active an element in her conduct in this case as any possible apprehension on the score of Mary's religion and nearness to the throne. It is difficult to say how far the colonising enterprise of her reign was owing to causes independent of her, and how far to her political wisdom. Some think her to have forwarded the schemes of Drake, Raleigh, and the other adventurers of the age, simply from motives of mercantile prudence, in this respect showing herself the worthy granddaughter of the astute Henry VII. What seems to us, judging from a distance, the absurdly exaggerated reverence felt for her by her courtiers bears witness to the extraordinary strength of her character, for it is impossible to suppose it all to have been lip-service and high-flown romance. Her conduct with regard to her favourites, Leicester and Essex, has puzzled many, but to be her favourite must have been like playing with a tiger. She was in no way backward in letting them see and, on occasion, feel her claws. She knew how to value Burleigh, and, no doubt, thoroughly understood Leicester, and found some ironical amusement in befooling Alençon, and puzzling her own "good people." The masterly policy of posing as the champion of a Protestantism which she probably cared little for, and the glory of having humbled the first military power of the world, may fairly be divided between the queen and her gifted advisers. Knowing when and how gracefully to yield, she reigned in her people's hearts with a more absolute sway than has been attained by any English ruler before or since. Her good education and love of learning was not so unusual a quality in her day as it became later. In this respect Lady Jane Grey was at least her equal. There is some mystery attaching to her early connections with Seymour, High Admiral of England, who had paid her attentions when she was a girl of sixteen. It is just within the bounds of possibility that faithfulness to his memory may have

had something to do with her determination not to marry. It should not be forgotten that it is said that we owe Shakespeare's *Merry Wives of Windsor* to Elizabeth's desire to see something more of Falstaff and his oddities.

Elizabeth, Empress of Russia (1710-1762), was the daughter of Peter the Great and Catherine. In 1741 she succeeded to the throne owing to a conspiracy of the old party, which was opposed to the innovations which had been introduced by Peter the Great. Elizabeth was beautiful and licentious, and her government, which was carried on by a succession of favourites, was tyrannical and capricious, and banishment to Siberia was freely used. She patronised literature, and corresponded with Voltaire, to whom she supplied material for his life of Peter. She founded the University of Moscow, and the Academy of Fine Arts at St. Petersburg. Besides her lovers she had a husband of low rank. She had a war with Sweden, which ended with the Peace of Abo, she aided Maria Theresa in the War of Succession, and she was engaged in the Seven Years' war at the time of her death.

Elizabeth, St., of Thuringia (1207-1231), was born at Pressburg. In 1221 she married Louis of Thuringia, and the pair seem to have led a kind of ideal life, he devoting himself to knightly deeds, and she founding hospitals and attending the sick and poor. Louis died while on a crusade, and his widow died in one of her own hospitals. Four years after her death she was canonised by Gregory IX. A church was built over her tomb and a monument, which is one of the finest examples of Gothic in Germany.

Elizabeth of Bohemia (1596-1662) was the daughter of James VI. of Scotland (James I. of England) and Anne of Denmark. She was born in Fife, and resided while in Scotland at Linlithgow. When she came to London, Combe Abbey was appointed as her place of residence, and here she was brought up. She then removed to Hampton Court, Whitehall, and Kew respectively. Charles IX. of Sweden sought her hand for his son, but she was married to Frederick, Elector Palatine, who was elected to the throne of Bohemia. She seems to have been flighty and extravagant, and she did not win the hearts of the inhabitants of Prague. Prince Rupert, of Civil war renown, was her third son. Her husband was deprived of the Bohemian crown by the battle of Prague. Elizabeth came to England at the Restoration, and died in London. She was popular in England, and was generally known as the Queen of Hearts.

Elizabethan Architecture, a combination of debased Pointed and degenerate Italian architecture which prevailed in the time of Elizabeth and James I., and succeeded the Tudor style. Though improper in style, it was picturesque in appearance, among its features being embayed windows, long galleries, and elaborate chimney stacks.

Elk (*Alces machlis*), the largest living species of the Deer family. It is a native of Arctic

America, where it is also called the Moose, and of northern Europe and Asia, though much more numerous in the western than in the eastern hemisphere, where its distribution has been much restricted since the days of Caesar (*De Bello Gall.* vi. 27). An adult male stands about seven feet high at the shoulders, and has huge palmate antlers, which form effective weapons of defence, and which have been known to weigh 40 lbs. The antlers appear first as straight bony projections when the animal is about nine months old, reaching their full length in the fifth year; and in each succeeding year till the fourteenth, when the animal is considered full-grown, they increase in breadth and add a fresh point to the broad, spreading margins. The females have no antlers. The coat is harsh and close-set, deep blackish-brown in colour, and forms a kind of a mane; the neck is short and thick, with a pendulous swelling covered with hair under the throat, just behind the angle of the jaw; the limbs are long, and the tail rudimentary. Their pace is generally a shambling trot, and their long legs enable them to get over the ground very quickly. In Sweden they were formerly trained to draw sledges, but this practice has long died out. They are, for the most part, solitary and very wary, so that moose-hunting, according to Sir John Richardson, is the greatest of an Indian's acquirements. They feed on bark and the shoots of bushes and trees. The skin makes excellent leather, and the flesh good venison, the tongue and the muffle, which is large and prominent, being specially prized. A few are still carefully preserved in Lithuania.

ELL (from Latin *ulna*, the elbow), a measure formerly commonly much used in Europe, and supposed to be the length of the forearm. It is thought to have been introduced into England from France during the Tudor period. There is much difference between the ells of different nations—that of England being 45 inches, that of Scotland a little over 37 inches, and that of Flanders 27 inches.

Ellenborough, EDWARD LAW, EARL OF (1790–1871), was the son of Baron Ellenborough, Lord Chief Justice of England. He was educated at Eton and St. John's College, Cambridge, and in 1814 entered Parliament, retaining his seat until 1818, when the death of his father removed him to the House of Lords. In the same year he became a member of the Duke of Wellington's government. From 1828 to 1830 he was President of the Board of Control, and in 1834 and in 1841 he was in Sir Robert Peel's ministry. He then became Governor-General of India, arriving in that country in time to direct the Afghan war of 1842. In the next year Sir Charles Napier conquered Scinde, and then followed the conquest of Gwalior; but Lord Ellenborough's policy and manners gave dissatisfaction at home, and the Company recalled him in 1844. He received the thanks of Parliament, the Grand Cross of the Bath, and an earldom. In 1846 he was First Lord of the Admiralty, and in 1858 he was President of the Board of Control in Lord Derby's government, but resigned in consequence

of the general disapproval of a despatch he wrote censuring Lord Canning's policy as Governor-General. He did not again take office.

Ellice Islands is the name given to some groups of coral islands in the South Pacific, lying in lat. 5° to 11° S. and long. 177° to 180° E. The Polynesians who inhabit them are mostly Christians, and the islands belong to Great Britain. The only product of importance is copra.

Ellichpur, an Indian city in the north of Berar, once the capital of the Deccan. The town is decaying, but contains a ruined palace, some tombs of nawabs, and a shrine. The district of the same name is in the commissionership of East Berar, and has an area of 2,772 square miles.

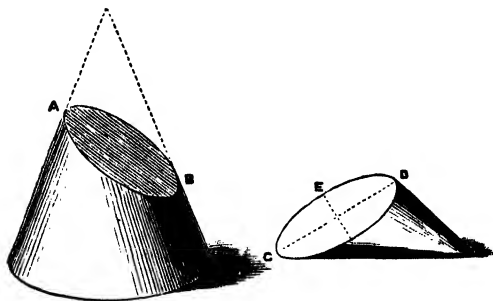
Ellicott, JOHN (1707–1772), a clockmaker and man of practical science in the 18th century. He was renowned for the beauty and excellence of his workmanship, and was appointed clockmaker to George III. In 1736 he made improvements in the pyrometer, in 1738 he became a F.R.S., and in 1739 he wrote papers on the influence of two pendulums on each other. Other of his contributions to science were essays towards the discovery of the laws of electricity; a compensated pendulum, experiments on the moon's motion, and an examination into the specific gravity of diamonds.

Elliot, EBENEZER (1781–1849), called "the Corn Law Rhymer," was born at Masborough in Yorkshire. His love of nature and of contemplation gained him, as such qualities generally do, the reputation of being dull and idle. But he studied botany, and worked hard at educating himself. He produced his first poem, *A Vernal Walk*, at the age of seventeen. After working for a time in a foundry, he was an iron-merchant in Sheffield (1831–1837). His *Rhymes* were produced at intervals, and were collected into one volume with the *Ranter*. In 1829 appeared his *Village Patriarch*. Many of his pieces contain good descriptions of Yorkshire scenery.

Elliotson, JOHN (1791–1868), an English physician born at Southwark. He took the degree of M.D. at Edinburgh and at Cambridge, and then studied in London, and in 1817 became assistant physician and, later, physician of St. Thomas's Hospital. He lectured at St. Thomas's till 1831, introducing there the new practice of clinical lecturing. In 1834 he became physician to the North London Hospital, but a few years later resigned all his appointments, owing to his having adopted mesmerism as a therapeutic agent. In 1849 he became physician of a mesmeric hospital. Dr. Elliotson made many valuable discoveries in medical practice, among them being the use of acupuncture in neuralgia, the value of quinine, the importance of the stethoscope, and the employment of many substances in different diseases.

Ellipse, one of the conic sections, every point of which has the property that its distance from a fixed point or *focus* is a constant fractional portion of its distance from a fixed line or *directrix*. This definition renders the ellipse a closed curve symmetrical about two axes at right angles to each

other—the one parallel to, and the other perpendicular to, the given directrix. There are two foci and two directrices, and an important property that may be said to define the curve is that the



sum of the distances of any portion of the curve from the two foci is a constant length, equal to the major or longer axis of the ellipse. The curve is completely determined by its two axes, major and minor. Their point of intersection is called the centre of the curve, and possesses the usual properties of that point. [CENTRE.] If the semi-axes are a and b the area of the curve is πab . When the axes become more and more nearly equal the curve approximates to the circle, which is therefore only a special case of ellipse. The length of the circumference cannot be exactly expressed in a finite number of terms, though close approximations have been found. The eccentricity of the ellipse is measured by the distance from focus to centre divided by the semi-axis major. The curve may be drawn by the trammel or elliptic compass.

Ellipsoid, one of the quadric surfaces, or surfaces such that any plane section gives a conic (q.v.). The true ellipsoid has three axes of symmetry at right angles to each other, each of different length. They meet at a point called the centre, which bisects them and all chords or diameters, as they are called, which are drawn through it and terminated by the surface. Any section of an ellipsoid is an ellipse, but there are two directions in which sets of circular sections may be obtained; the circle is regarded as a special case of ellipse. If a , b , and c are the semi-axes of an ellipsoid its volume will be $\frac{4}{3} \pi abc$. If two of these are made equal a surface called a *spheroid* is obtained that may be generated by the rotation of an ellipse about either of its axes. If rotated about its major axis, a *prolate* spheroid is produced; if about its minor axis, an *oblate* spheroid. The shape of the earth is an instance of the latter. If all three axes be made equal the sphere is obtained, which must, therefore, be regarded as a special case of ellipsoid. All sections of a sphere are circular.

Ellis, SIR HENRY (1777-1869), sometime chief librarian of the British Museum. He was born in London, and educated at Merchant Taylors and at St. John's College, Oxford, of which society he became fellow. He was for a time sub-librarian of the Bodleian Library, from which he migrated to

the British Museum, being chief from 1827 to 1856. Among his works are an edition of Brand's *Northern Antiquities*, the introduction to the Domesday Book, and a collection of original letters illustrative of English history.

Elliston, ROBERT WILLIAM (1774-1831), an actor born in London. His first appearance on the stage was at Bath, where he played Romeo in 1793. He came to London, and played at the Haymarket and at Covent Garden. He was twice a member for some time of the Drury Lane Company, and for five years was lessee and manager, but became bankrupt, and appeared later at the Surrey Theatre. Lamb appreciated him, and Leigh Hunt praises his comedy and his tragedy.

Ellora, a village of Hindostan, in the Nizam's dominions in the Deccan, 12 miles N. of Aurangabad. Its ruins are surrounded by a stone wall, but its great feature is its cave temples in the slope of a hill of red granite. The general form is that of a horseshoe of one mile in extent. Some of the temples are caves, and some are open at the top, and they are some Buddhist and some Brahmin. The largest and finest is dedicated to Siva, and consists of a solid mass of rock one hundred feet high, round which are excavated galleries and colonnades having the whole Hindu Pantheon elaborately carved upon them. A smaller temple is the Buddhist cave of Visvakarma. This has a curved roof, and contains a colossal image of Buddha.

Ellore, a town in the Godavari district of the Presidency of Madras. The town is healthy, and is the head of the sub-district, and has a population of which the majority are Hindu. The manufacture of carpets is largely carried on.

Ellwood, THOMAS (1639-1713), a Quaker author, born at Thame in Oxfordshire. In 1660 he was led to join the Society of Friends by the preaching of Edward Burroughs. Soon after this he published an *Alarm to Priests: a Message from God to Awake Them*. His religious views brought him into prison. He became reader for Milton, and having been forced by ill-health to leave London himself, he in 1665 obtained lodgings for Milton at Chalfont in Bucks, and it was here that a remark of his led to Milton's writing *Paradise Regained*. In 1705 Ellwood issued a *Sacred History* dealing with the Old Testament, and in 1709 the *Sacred History of the New Testament*. He also wrote a poem called *David's*, and an autobiography, which is valuable as throwing light upon the condition and habits of the sect at that time.

Elm, the popular name for the various trees and shrubs forming the genus *Ulmus*, a group of about a dozen species native to the North Temperate region, and forming the type of the small apetalous order *Ulmaceae*. They have furrowed, corky bark; scattered, simple, oblique leaves with caducous stipules; tufts of hermaphrodite flowers, generally produced before the leaves; from four to nine lobes to the bell-shaped, persistent calyx; an equal number of stamens; and a two-chambered, one-seeded samara (q.v.) with a membranous wing all

round it. The species are very variable, becoming mere shrubs in the far north, but forming large timber-trees, 60 to 100, or even 150 feet high, farther south. *U. campestris*, the common or English elm, most common south of the Trent, reaches the greatest height, and often sends out very long, horizontal limbs. It is multiplied by suckers—its fruit, in which the seed is above the centre, seldom ripening. It is, partly on this account, believed not to be indigenous in England. It attains maturity at 150 years; but may live to 600 years. The Wych or Scotch elm, *U. montana*, more common north of the Trent, has a more drooping habit, no suckers, and its seed in the centre of its fruit. The American elm, *U. Americana*, has its samara fringed with hairs, and another American species, the Slippery elm, *U. fulva*, has a mucilaginous inner bark, useful as an ointment. Elm leaves form a useful fodder, and the branches of the Wych elm were formerly used for bows. The whitish sapwood is as strong as the brown heartwood and used to be made into linen-chests and hollowed out into water-pipes. Being durable when alternately damp and dry, elm-timber is used for keels and pumps; but is now mainly employed in coffin-making. In Italy the tree is still used, as in the time of Virgil, as a prop for the vine. It is a favourite avenue tree, the soft-wood Dutch variety having been largely planted for this purpose during the last two centuries.

Elmalu, a town in Lycia, Asia Minor, 45 miles W. of Adalia. The chief industries are dyeing, and the manufacture of red leather, and there is some trade.

Elmina, a British town on the west coast of Africa, 5 miles W. of Cape Coast Castle. It is a large and dirty native town occupied by traders and fishermen. It is protected by a castle. It passed from the Portuguese to the Dutch, and was the capital of their Gold Coast possessions, and was ceded by them to Great Britain.

Elodea canadensis, or *Anacharis Alismastrum*, the American water-weed, a submerged aquatic plant belonging to the order Hydrocharidaceæ. Its long, much-branched stems are very brittle, and, as they root freely at the nodes, the plant, broken up by water-birds, has spread rapidly, though, as it is dicaceous, it does not seed in England. Its whorled, linear-oblong leaves clearly exhibit the rotation of the protoplasm in their cells. Introduced from America into Ireland about 1836, and into England about 1841, it spread rapidly throughout our rivers, canals, and ponds, and has since proved a great hindrance to mills and to navigation.

Elohim, a Hebrew name for God, perhaps akin to the Arabic *Allah*. It is a more generic name than Jehovah, which is confined to the God of the Jews. It is in the plural form, and many conjectures have been started to account for this peculiarity.

El Paso, a Mexican town in the State of Chihuahua, on the Rio Grande, 340 miles S.W. of Santa Fé, and near the frontier of New Mexico.

The name is derived from its being the pass between Mexican and United States territory, and is applied to a number of settlements in the same valley along the Rio Grande. The valley is fertile, and produces wine and brandy, but the town is wretched. A railway bridge over the river connects El Paso with a town of the same name in Texas.

Elphinstone, HON. MOUNTSTUART (1778-1859), the 4th son of Lord Elphinstone, entered the Bengal Civil Service at eighteen, and was appointed attaché to the British resident at the court of the Peishwar. He was then attached to General Wellesley's mission to the Mahratta chiefs, and took part as aide-de-camp in the battle of Assaye. In 1808 he was sent on an important mission to Cabul and Peshawar, which resulted in a satisfactory treaty. In 1819 he was appointed Governor of Bombay, and retained the post for seven years. He advanced the codification of the laws, and opened many schools, and his efforts in this direction were acknowledged by giving his name to a college. In 1841 he published his *History of India*. He was offered the post of Governor-General of India, but he declined that and other similar offers.

Elphinstone, WILLIAM (1431-1514), a Scottish bishop and statesman, born at Glasgow, and educated at the grammar school there and at the University, where he graduated M.A. about 1451. After taking orders, and officiating in Glasgow for four years, he went to Paris to study canon and civil law, and worked for six years there as a professor. Returning to Scotland he became Rector of Glasgow University, and in 1478 a member of the Privy Council. King James III. made him Bishop of Ross for the ability he displayed in bringing about a good understanding between the Scottish court and Louis XI. of France. Later he became Bishop of Aberdeen, and Lord Chancellor. In 1488 he was sent to negotiate a marriage between James IV. and the Emperor Maximilian's daughter. From 1492 he was Lord Privy Seal, and the king put great trust in him. He is thought to have obtained the papal bull for the foundation of Aberdeen University, and was the principal founder of King's College, as he left a sum for its erection and endowment, and the maintenance of a bridge over the Dee. He wrote a *History of Scotland*, now among the MSS. of the Bodleian, and the lives of some Scottish saints.

Elsinore, a Danish seaport on the island of Zealand, on the Sound, which is here $3\frac{1}{2}$ miles broad. It is 24 miles W. of Copenhagen, and has two churches, a school, and a custom house. The inhabitants are engaged in commerce, seafaring, and in traffic with Helsingborg, the Swedish town on the opposite side of the Sound. The Castle of Kronborg, built by Frederick II. (1580), commands the Sound, and till the redemption of the Sound dues in 1857, all vessels had to salute the Castle and pay toll there. There is a good view from the lighthouse, which has a fixed light at a height of 113 feet.

Elsler, FANNY (1810-1884), and THÉRÈSE (1808-1878), two dancers born at Vienna. They

made a great impression at Berlin in 1830, and were well known in all European capitals. A visit to America in 1841 brought them fresh triumphs. They retired in 1851, and Thérèse was ennobled upon her marriage with Prince Adalbert of Prussia.

Elster, the name of two German rivers. 1. The White or Great Elster rises in the W. of Bohemia, flows N. to Saxony, and joins the Saale near Halle, after a course of 115 miles. The Pleisse and Parde flow into it at Leipzig. 2. The Black Elster rises in Saxony, flows N. into Prussia, and then N.W. into the Elbe near Wittenberg, after a course of 100 miles. The Pulsnitz and the Röder flow into it.

Elswick, a township adjoining Newcastle, chiefly noted as being the spot where the great engineering and ordnance works of Armstrong, Whitworth and Co., Newcastle and Manchester, occupy an area of 200 acres, river frontage two miles, and at times employ as many as 24,000 people.

Elton, CHARLES ISAAC, Q.C. (b. 1839), a writer upon law and ethnology. He was born in Somerset, and educated at Cheltenham, and Balliol College, Oxford, where he graduated, and was elected a fellow of Queen's College. He was called to the bar in 1865, and sat in Parliament for W. Somerset. His legal works are mostly upon outlying points of law embodying old and local customs, such as Borough English. In *Origins of English History* he urges the importance of the Celtic element in the population of England. He died in 1900.

Elu, the ancient language of Ceylon, still spoken in modified form by the Sinhalese natives of the southern half of the island. It has long been cultivated, and is written with a peculiarly elegant alphabet somewhat resembling the Telugu of Madras, and, like it, derived from the Devanagari [DEVANAGARI] of the Asoka inscriptions. Elu holds a somewhat intermediate position between the two great Sanscritic and Dravidian linguistic families. It abounds in grammatic forms, and is certainly much older than any of the Prakrits though grouped by Childers and Beames with the Neo-Sanscritic tongues, owing to its numerous Sanscrit and Pali elements; but in its structure it shows more affinity for the Dravidian, though in many respects differing essentially from that family (Caldwell, *Grammar of the Dravidian Languages*; Petchel, *Races of Man*, English ed., p. 454).

Elutriation, a process of separating small particles of earthy materials from heavier ones by means of water. It is used in the pottery and pigment industries.

Elvan, a Cornish term for veins of a crystalline-granular mixture of quartz and orthoclase-felspar, intermediate between granite and eurite. They mostly proceed from granite bosses, penetrating both granite and surrounding slate, and frequently enclosing angular fragments of slate. They vary in width from a few inches up to 300 feet, and in Leinster they can be traced for miles in parallel bands 200 to 300 yards apart. The rock of which they are composed is termed *elvanite*.

Elvas, a town of Portugal in the province of Alemtejo, near the Spanish border, 12 miles N.W. of Badajos. It is situated upon a height which, with two on each side, is defended by a castle, and its situation under former conditions was well-nigh impregnable. The streets are narrow and crooked, but there are many good Moorish houses. The cathedral is a mixture of Moorish and Gothic, and there is a Moorish aqueduct 15 miles long, which crosses a valley on four sets of arches at a height of 250 feet.

Elves. [FAIRIES.]

Elwes, JOHN (1712-1789), was a wealthy miser or rather monomaniac, born at Southwark, and educated at Westminster. In his younger days he travelled on the Continent, and was fond of riding and hunting; but a sudden inheritance from a wealthy uncle, whose name he took, developed in him the eccentricities that made him notorious. He was an amiable miser, since it was only on his own person that he begrudged expenditure, while he did many a kind action, and kept up a good stable and kennel. He represented the county of Berkshire in Parliament from 1774 till his death.

Ely (in Latin *Elia*), a cathedral town of Cambridgeshire, on a height on the left bank of the Ouse, 15 miles N.E. of Cambridge. It consists of one principal street, from which branch several smaller ones, and which has a market-place in the centre. The most notable of its buildings is the abbey-cathedral of St. Etheldreda, on the site of a monastery founded by her in 673. It is 517 feet long from east to west, and the western tower is 270 feet high. There is a beautiful Norman nave, and most of the succeeding styles have been harmoniously incorporated. The Precincts are entered by a fine gateway of Richard II.'s time. The church of the Holy Trinity is a good specimen of 14th century architecture. There are a Town Hall, a Corn Exchange, and a cattle market and some very old houses. The town has no special manufactures, the industries of the neighbourhood being chiefly agricultural, and there are several market gardens near it. A sight of Ely from the railway when the floods are out gives a good idea of its former appearance. Pop. (1901), 7,713.

Elyot, SIR THOMAS (d. 1546), an English man of letters, born in Suffolk or in Wiltshire, and educated at Oxford or at Cambridge. He was Clerk of Assize on the Western Circuit, and afterwards clerk of the King's Council, and was employed on different embassies. Most of his life, however, seems to have been passed in a struggle with poverty. He had much reputation as a scholar, his chief works being a *Latin Dictionary* of encyclopædic nature, and the *Governor*, a book treating at length the education and bringing up of the young.

Elysium (or sometimes the ELYSIAN FIELDS), in ancient times the supposed habitation of the blessed when they have departed this life. Its exact position in space was never definitely settled, being variously put at the outside of the earth, at the antipodes, at the centre of the earth, and in the

Fortunate Isles (now the Canaries); but it was an abode of physical and intellectual delight from which all care and toil were banished.

Else, FRIEDERICH KARL (1821-1889), a German scholar who studied and wrote upon Shakespeare. He was born at Dessau, and made part of his studies in Great Britain. From 1875 till his death he was Professor of English Language and Literature at Halle. He edited *Hamlet*, wrote *Essays on Shakespeare* and *Notes upon Elizabethan Dramatists*, and a *Biography of Lord Byron*.

Elsevir, the name of a noted family of printers and publishers who flourished at Amsterdam and Leyden in the 17th and late 16th centuries. The best-known are LOUIS, who was the first to distinguish in printing between *u* and *v*; MATTHEW and ABRAHAM, who with Buonaventura produced the highly-prized 12mo and 16mo edition of Virgil, Terence, etc.; ISAAC, JOHN, and PETER, who worked at Utrecht. It was chiefly for its editions of the Latin classics that the house was renowned, other houses, notably the Eltiennes of Paris, excelling them in Greek and Hebrew editions. It is rare to find an antiquary or bibliophile spoken of in fiction without mention of his valued "Elsevirs."

Emancipation, a solemn act by which under the Roman law a father divested himself of his power over his child, so that the child became *sui juris*. This cannot happen under English law, but by the French law a father or mother (being a widow) may by a simple declaration emancipate a child at the age of 15 years, and the marriage of a child, at whatever age, operates as an emancipation. An orphan of the age of 18 years may be emancipated by a decision of the *conseil de famille*. The effects of emancipation are to render the child competent to act generally on his own account in all matters of a purely administrative character, but he remains subject to all former disabilities in respect of the alienation of capital, of real estate, of loan transactions and the like. If a trader, his capacity is unlimited.

Emanuel, called "The Great" (reigned 1495-1521), King of Portugal. His reign is spoken of as the "Golden Age of Portugal," for during it were reaped the fruits of the discoveries of Vasco da Gama, Cabral, and Amerigo Vespucci, Albuquerque's discovery of a passage to the East Indies; and the acquisition of Goa, the Brazils, and the Moluccas. The commerce of Portugal, too, reached its highest prosperity, the evil effects of Emanuel's expulsion of the Moors and Jews from his dominions not yet being felt. The king was a patron of learning, and wrote memoirs on the Indies.

Emballonurine Alliance, one of the two groups into which the sub-order Microchiroptera is divided. The tail perforates the membrane between the thighs and appears on its upper surface, or is produced beyond the truncated membrane. [BAT, 2.]

Embalming, the process of preserving bodies—human or other—from decaying by the use of medicaments. Many nations, including the ancient Peruvians of South America, have employed the art; but it is chiefly known to us from its use among

the ancient Egyptians, owing to the number of mummies which fill our museums. Herodotus gives some interesting details of the process, from the elaborate system employed by the wealthy to the comparatively simple one that served the turn of the poor. The Egyptians not only embalmed human bodies, but also those of their sacred crocodiles and cats, the latter of which a few years ago underwent the sacrilegious degradation of being shipped in quantities to Europe for manure, just as their masters have become a stock curiosity for museums, and, it is said, have before now served as fuel on the overland railway. The most usual form of embalming among the Egyptians was to remove the brain and viscera and to fill up the cavity with aromatic and bituminous substances, and to wrap the body in cloth steeped in resinous materials, and then put it in a highly ornamented coffin. The duration and completeness of the process depended, like the pomp of a modern funeral, upon the amount of money expended. Many modern systems of embalming have been employed, some of which profess to preserve the whole body—flesh, skeleton, and viscera alike. By one process the body is petrified, and a table has been constructed out of human remains, quite solid, and taking a high polish.

Embankments, in *Engineering*, are employed for railways, elevated canals, roads, reservoirs, etc. In the case of railways and the like, they are only subject to vertical pressures due to the loads they carry and to their own weight; their dimensions are therefore calculated in relation to this and to the angle of repose (q.v.) of the material employed in their construction. Embankments for reservoirs or defence from encroachments of water have to withstand the lateral pressures of the water on one side of them, and must also be rendered impervious to water in case they should be gradually undermined. [DAM.]

Embargo (Spanish from a Low Latin word *imbaricare*, and from *barra*, a bar) generally implies a prohibition in time of war laid by a state upon foreign ships, especially the enemy's, to prevent their leaving the ports they happen to be lying in. The word is also used to signify the arrest of a ship or merchandise by process of law, and also in the general sense of a requisition.

Ember Days, certain ecclesiastical seasons set apart for praying for a blessing upon the fruits of the earth. The word is said to be a corruption of *quatuor tempora* (four seasons), and the uniform times for holding them were fixed by the Council of Piacenza in 1095. These times are the Wednesday, Friday, and Saturday after the 1st Sunday in Lent, Pentecost, the Feast of Holy Cross (14th September), and the Feast of St. Lucy (13th December). The Sunday after the Ember week is generally chosen for Ordinations.

Emberiza, a genus of birds formerly classed under the order *Insectores* and tribe *Conirostres*, and closely allied to the finches. It includes the yellowhammer, the various buntings (q.v.), the nonpareil and rice-bird of the Southern United States, and perhaps the whydah birds. All are largely insectivorous, though their main food is seed.

Embezzlement (from the old French word *beseler* or *embeseler*, to filch) is another term for stealing, but more particularly applicable to stealing by clerks, servants, and others in official positions of money or goods received by them on account of their employers. It is distinguishable from larceny, which is the taking or misappropriation without the will of the owner, which does not apply where a clerk, servant, or agent is entrusted with funds; but, in embezzlement, the offender *intercepts* and misapplies money or other things, and this constitutes the offence under the statute. The offence is a felony, and punishable by penal servitude or imprisonment, and in the case of a male under the age of 16 by whipping in addition to imprisonment. In case a larceny is proved upon indictment for embezzlement the offender may be convicted of the former offence and *vice versa*. Any number of distinct embezzlements not exceeding three committed within a period of six months may be joined in the same indictment. Partners stealing or embezzling money, etc., the property of the partnership, may now be convicted and punished as if they had not been such partners. [LARCENY.]

Emblem (from Greek *emballein*, to insert) originally signified inlaid or mosaic work. It now is restricted to a picture or representation which has a secondary signification beyond that presented to the eye. For instance, the dove or lamb is the emblem of innocence, the serpent or owl that of wisdom, the pelican that of the Church, and so on.

Embolism. [PYÆMIA.]

Embolus. [VEINS.]

Embossing, the practice of raising figures in relief half, high, or low (mezzo, alto, basso rilievo) upon surfaces such as paper, wood, leather, bronze or the like. Some substances are embossed by means of dies which under great pressure depress the parts not intended to be in relief. A method of embossing upon wood is to depress the parts intended to be in relief, then to plane the wood to a level with them, and to soak it in water, when the depressed parts rise to their former level.

Embracery (from the French word *embrasseur*) is an attempt to corrupt or influence a jury in favour of one of the parties in a suit. It is punishable by fine and imprisonment. The crime is complete whether the jury on whom the attempt is made give any verdict or not, or whether the verdict be true or false.

Embrasure, a term employed in fortification to denote an opening in a wall or embattlement through which a gun may be trained, or the space in a wall sloping laterally towards a window. In the case of the embrasure for a gun the narrow part is inward, the sides sloping outward to admit a wider lateral range for pointing a gun, in the case of a window the wider part is towards the interior. An embrasure may be either direct, *i.e.* at right angles to the side of the wall through which it is pierced, or oblique, *i.e.* at an acute angle with such side.

Embroidery, a figured design or pattern worked by the needle upon muslin or stuff, the material for the figure being generally gold, silver, or silk thread. Muslin stretched upon a frame is often the groundwork of the embroidery. The art seems to have been invented in the East, and to have passed from the Persians to the Greeks, though the latter attributed its origin to Pallas Athene. The king of Pergamus is said first to have used gold thread, and the women of Sidon were renowned for their skill in the art. A familiar example of it is the sampler of a few generations ago, specimens of which are to be seen in most houses.

Embryo, in cormophytic plants the result, direct or indirect, of the fertilisation of the oosphere. In the lower liverworts (q.v.), such as *Riccia*, this cell, when fertilised is known as the oospore, divides into octants, periclinal walls afterwards dividing off a peripheral cell-layer, and the whole interior becoming the spore-mother-cells of the sporogonium. In higher forms the basal half of the embryo forms a stalk, which may be expanded below into a "foot," by which the sporogonium or sporophyte generation keeps up a quasi-parasitic connection with the oophyte or previous (sexual) generation. The central part of the upper, or apical, half of the embryo may be non-sporogenous, forming a "columella," over which the sporogenous tissue is developed like a bell. In some of the lowest mosses the development is much the same; but, though the successive cell-divisions occur in a variety of ways, there is generally a distinct wall, columella, and bell-shaped or cylindrical sporogenous layer (archesporium). In the Pteridophyta the oospore gives rise not merely to a sporogonium or fruit-like appendage, but also to the whole leafy plant, and the embryo, whilst still within the cavity (venter) of the archegonium (q.v.), shows indications of a primary root, a leaf or "cotyledon," the apex of the stem or "plumule," and a foot. In ferns the embryo divides into octants, one of which forms the growing point of the stem, one at the other end the root, two others forming the cotyledon, and two the foot. In *Selaginella* (q.v.) and in almost all flowering-plants the upper half of the oospore goes to form a temporary chain of cells known as the *pro-embryo* or *suspensor*, the embryo arising from the lower half. In flowering plants the embryo has usually so far developed before the seed is ripe that cotyledons, plumule, and radicle are distinct; but some parasites, saprophytes, orchids, etc., have embryos, which remain rudimentary as mere undifferentiated masses of cells until after the dispersal of the seeds. In Gymnosperms the suspensor sometimes separates into parallel cell-chains, each terminated by an embryo, and more than one embryo may begin to develop in a single seed (polyembryony). In Angiosperms the two last cells of the suspensor contribute more or less to form the embryo, the development of which is very different in Monocotyledons from what it is among Dicotyledons. In the former there is generally one terminal cotyledon and a lateral plumule; in the latter, two

cotyledons, one on either side of the apex and a terminal plumule between them. In both cases the root is terminal, being produced at the attached or suspensor end of the embryo and growing out of micropyle (q.v.) in germination (q.v.). In the dicotyledonous embryo it is generally possible at an early stage to distinguish three primitive tissues—viz. an outer layer, the *dermatogen* or primitive epidermis; a central axis of elongated cells, the *plerome*, from which pith and fibro-vascular tissue originate; and, between them, the *periblem*, or primitive cortex. The embryo is nourished by the surrounding tissue of the oophyte in mosses and pteridophytes, i.e. the prothallus in the latter; but in *Selaginella* and in flowering-plants there are special nutritive tissues, the *perisperm* (q.v.) and *archisperm*, or *endosperm* (q.v.).

Embryology is that branch of biology which deals with the series of stages through which an animal or plant passes in its development from the primitive egg or ovum to the adult. The subject can be divided into two divisions, one dealing with the development of the entire animal, and the other with the development of the tissues of which the animal is composed. The former is known as ontogeny; as the latter is really only a branch of histology it will not be further noticed here. The subject is practically limited to the multicellular animals (Metazoa), as, though parts of the single cells of the Protozoa (q.v.) undergo certain modifications these do not mark definite stages of development, and therefore do not fall under the scope of embryology. Among the Metazoa the life cycles may be very clearly marked, or the transitions may be gradual and obscured in the parent. A metamorphosis such as that of the egg, caterpillar, chrysalis, and butterfly, is the best illustration of the former; the higher mammals, in which the young differ from the adult only in size and the imperfection of genital organs, are cases of the latter. The oviparous vertebrates, or those which lay eggs, afford the best facilities for the study of development, and it was upon the chicken that the first systematic observations were made by Galen, a Greek philosopher who lived from 130 to 200 A.D. He noted the successive stages in the development in the egg, but it was not until Harvey's discovery of the connection between the cicatrula of the yolk and the rudiments of the young bird that further important progress was effected. In the latter half of the 17th century Malpighi (1672), Vallisneri (1689), and Needham (1667), carried on Harvey's work, while in the 18th century Bichat, Wolf, etc., accumulated a considerable amount of information, which was first systematically arranged in the masterly series of memoirs by Von Baer (1820-1830). His discovery of the ovum in man and other mammals led to investigations upon the earlier stages of other vertebrates than the birds which had previously monopolised attention. His enunciation of his famous law that development proceeds from the generalised to the specialised gave the subject an important philosophical bearing, and his teaching that "developmental history is the best clue as to the affinities

of an organism" stimulated research upon the embryology of the invertebrates. The way was thus prepared for the work of Johannes Müller on the development of the Echinoderms, and for Vaughan Thompson's demonstration that the Rosy Feather Star (*Antedon*) was a Crinoid and not a Starfish. It was not, however, till Kovalevski's work on Amphioxus and the Ascidians proved how fundamentally their structure and affinities had been misunderstood, that embryology really gained full recognition as one of the most important elements in classification.

Meanwhile a still keener interest had been roused by Darwin's demonstration of the truth of evolution, which showed that the higher animals had been evolved from the lower in a manner analogous to the life-history of an individual. It was therefore thought that embryology would give certain indications of the exact line of descent. This view was well expressed by its most uncompromising advocate, Haeckel, in the dictum "Ontogeny (i.e. the life-history of an individual) is a summary of phylogeny" (i.e. the history of the descent of a class). Stimulated by such interests, embryological investigations multiplied, and the rapid growth of information rendered possible the work of F. M. Balfour. Later results have led to a reaction by showing that though the theory expressed in Haeckel's maxim is right to a large extent, it is far from being absolutely true. They have shown that development is very complex, that it has been modified by many different factors, and that a short and abbreviated development is a great advantage both by securing economy of energy, and by reducing the period of dependence or weakness of mother and offspring. These have produced such great alterations in the embryological record that implicit reliance cannot be placed on it. For example, very closely allied animals, even different species of the same genus, may have very different life-histories. Thus *Hemaster carenosus* (an Echinoid) has a direct development (i.e. there is no metamorphosis, the young being born as Hemasters), but in most of the species, such as *H. expergitus*, there is the usual metamorphosis, the young being born in the condition of *Plutei* (q.v.). Similarly most of the Lobsters and their allies pass at least through a *Zoea* stage, but in some, such as *Astacus fluviatilis*, the common Crayfish, these stages are skipped. A still more remarkable case has been recently described by Brook, who has shown that by altering the conditions under which development proceeds, the same species can be produced along two very different lines. In such cases an unqualified acceptance of Haeckel's law would necessitate the assignment of the two sets of individuals to quite different groups. Haeckel admits such cases, and regards them as exceptional "falsifications of the embryological record," but these are now becoming so numerous that the law no longer receives the full confidence once placed in it.

Though the developmental history is generally complex and varied in the higher forms, there are certain general characters common to the development of all the multicellular animals or Metazoa.

All begin as a single simple ovum, which by repeated subdivision forms into a large number of similar cells. The process of development consists in the arrangement of these cells, and their modification to form the various tissues and glands of the body. The ovum is a typical cell, and consists of a small mass of protoplasm (q.v.) surrounded by a clear envelope. The nucleus (q.v.) is known as the germinal vesicle, and within it is the germinal spot (nucleolus); the germinal vesicle is composed of a coiled thread or "reticulum" separated by a more fluid material, the "enchylema;" the reticulum elongates, and becomes arranged in a series of spirals known as the "karyokinetic figures." [KARYOKINESIS.] The result of this process is that the nucleus divides into halves, one of which (the female pronucleus) is ejected from the body; this process is repeated, so that only a quarter of the original nucleus remains. The meaning of this "ejection of the polar bodies" is still unknown in spite of many guesses. The male element or spermatozoon undergoes similar preparation; when mature it usually consists of a small head (the nucleus) and a fine whip-like "tail." The spermatozoa obtain access to the ova either in the body of the female, as in most of the higher vertebrates, or after they are shed as in the frogs, starfish, etc. The head fuses with the nucleus of the ovum, and as the result of this stimulus, segmentation or repeated subdivision commences; growth takes place at the same time, and the result is a "morula," or mulberry-like mass, composed of many similar cells. The cells then arrange themselves in a single layer forming a hollow sphere or "planula." This then becomes two layers either by the cells at one end growing round those at the other (epibole), or by the in-pushing of the cells at one end (embole). A much rarer method is that by "immigration;" certain of the cells give off buds on the inner margin; these become separated and form an internal layer. This method is met with in some sponges and hydroids such as *Obelia*. Either process leads to a blastosphere (q.v.), and the absorption of some cells at one end forms a mouth, or blastopore. The lower Hydrozoa (q.v.) such as *Hydra*, or "the fresh-water polype," remain permanently in a condition which, generally speaking, is identical with this.

The next advance is the formation of an ingrowth around the mouth, and the sea-anemone is a good type of the animals which remain in this stage. The next advance is one of great importance; ingrowths occur at both ends of the body and meet in the middle to form a continuous tube. This is the archenteron, and develops into the alimentary canal; it is sharply marked off from the body cavity, which is the space that intervenes between the walls of this tube and the walls of the body. The presence of such a body cavity or coelome is the characteristic feature of the Coelomata (q.v.). The two layers of the blastosphere are known as the epiblast and hypoblast, the latter being the interior. In all the Coelomata a third layer is formed between the other two, and is therefore called the mesoblast. The methods of its formation are varied and sometimes complex

[MESOBLAST], but that by the immigration of "mesamœboids" or small amœboid cells formed from either or both of the other layers is very typical, and may be conveniently studied in embryo of the common starfish, which is one of the most convenient types for the earlier stages. The mesoblast usually grows until the whole of the original body cavity (or archicœle) is filled up, and a new body cavity is then formed by the excavation of spaces in the mesoblast, or by outgrowths from the primitive alimentary canal. [COELOME.] Each of the three layers gives rise to a definite series of organs or tissues; from the epiblast are developed the exoskeleton, such as shells, hairs, some horns, scales, etc.; the external glands such as the mammary glands, organs of respiration—including gills, lungs, and anal gills; the nerves, brain, sense organs, and pituitary body. From the hypoblast are developed the notochord, the alimentary canal, except the mouth and anus (which are epiblastic), parts of the excretory organs, and the internal respiratory passages, or trachœe, etc., of invertebrates. From the mesoblast are developed the endoskeleton, the muscles, parts of the organs of excretion, and the generative organs.

Speaking generally, this description applies to any of the Metazoa, but there are numerous exceptions; for example, in *Peripatus* the ovum breaks up not into definite cells but into indefinite protoplasmic masses, which are not sharply marked off from one another; this is known as syncytial segmentation. As a rule these exceptions are on points of detail. Beyond this stage, however, it is not possible to give any account that will apply to all the phyla. The varied fate of the blastopore, which is, however, settled before this stage, illustrates the great differences that occur; thus it persists as the mouth in some worms, as the anus in *Patella*, as both in *Peripatus*, or it is lost entirely, or, as in insects, it is never formed. It is impossible in a general account to give any sketch of the types of development in each of the phyla of invertebrates; and cross reference should therefore be made to the articles on them and to those on the following invertebrate embryos, viz. Scyphistoma, Medusa, Pluteus, Nauplius, Zoœa, and Trochosphere.

The vertebrate group, however, requires special mention—especially in regard to the methods by which the embryo gets its food. The primitive ovum of all animals has its store of food either irregularly scattered through the ovum (alecithal), collected at the centre (centrolecithal), or at one end (telolecithal). In some vertebrates sufficient food or yolk is stored up in the egg, as with the birds, but in others the embryo has to obtain its nourishment from the parent; in those which are oviparous (*i.e.* lay eggs) the eggs may have an abundant food supply as in the case of birds, or the ova may be small and numerous; in the latter case development is rapid, and there is often a metamorphosis as with the frogs. In the case of those animals which develop somewhat slowly, some special arrangement is necessary for the nutrition and respiration of the embryo. This is secured by the development of two additional membranes the

amnion and allantois, which occur in reptiles, birds, and mammals—three classes consequently associated as the Amniota. The allantois was originally simply respiratory in function; in eggs it spreads over the inner surface of the shell, through the interstices of which sufficient air is able to penetrate. In all the mammals, except the egg-bearing monotremes, however, the allantois cannot be respiratory; it comes into contact with the wall of the uterus and splits up at the end into a number of processes, each of which fits into a depression known as "uterine crypt." By this the allantois becomes so intimately connected with the parent that the blood of the latter is able to penetrate by osmosis to the blood-vessels of the embryo; this is thereby nourished and the necessity for a special respiration of its own obviated. The yolkless yolk sac by which the embryo was originally attached to the parent undergoes reduction with the gradual increase in the importance of the allantois until it remains only as the rudimentary blastodermic vesicle.

Another point of great importance in the vertebrates is the origin of the central nervous system, which it has already been pointed out is epiblastic. A slight depression forms along the dorsal side of the embryo, and by the meeting of the margins above as this deepens the furrow is converted into a tube; this is thus lined entirely by the external layer, and from it the central nervous system is developed.

In regard to the relations between embryology and phylogeny there is one warning that may well be emphasised, and that is the necessity for distinguishing between primary characters and those which have been secondarily acquired. It is the former only which have any value on the phylogeny of the group. For example, the most familiar type of Echinoderm larva is the *Pluteus*, so named from the easel-like arrangement of the rods which support the ciliated arms; there can be little doubt that this arrangement is an adaptation to allow the larva to swim about. There is no reason to believe that the *Pluteus* was ever the adult form of any ancestor of the Echinoids. The impossibility of determining which characters are primary and which secondary is that which renders the embryological record as imperfect as that of palaeontology. [HEREDITY.]

Emden, a town of Prussia, in the kingdom of Hanover, on the right bank of the Ems (q.v.), near the entry of that river into the Dollart See. The streets are wide and well-paved, and the solid red-brick houses and the abundance of canals that intersect the town give it a Hollandish appearance. The Hofkirche dates from the 15th century, and has a lofty tower, as has the Stadthaus. The roadstead admits large vessels at all times, but the port—consisting of an outer and two inner harbours—is dependent upon the tide. The chief industries are shipbuilding, brewing, distilling, and the manufacture of leather, hosiery, tobacco, and soap. The chief exports are grain, dairy produce, gin, hides, tallow, and wool; and hemp, timber, potash, wine, and colonial produce are imported.

Em-egedesen, the people of the Agades uplands, Central Sahara, who are of mixed Berber (Tuareg) and Sonrhay (Negro) descent. The Emegedesiye language is a Sonrhay dialect identical with that still current in Timbuktu and surrounding districts. [SONRHAY.] But the Hausa and Berber languages are also spoken in Agades (H. Barth, *Travels*, vol. i. *passim*).

Emerald, the precious form of beryl (q.v.), having a fine green colour. As a gem it ranks after the sapphire and diamond in value. It has been successfully imitated in paste, the natural colouring matter, chromium-sesquioxide, being employed. The finest specimens come from Muzo, in New Granada, where they occur in a fossiliferous limestone. The *oriental emerald* is the very rare green variety of the sapphire.

Emerald Green, a fine green pigment consisting of a mixture of arsenite and acetate of copper, and hence of a poisonous character.

Emerson, RALPH WALDO, essayist and poet, was born at Boston, in the United States, May 25, 1803. He came of a high Puritan lineage, and his family was one of the oldest in America, his ancestors having gone out from Gloucestershire in 1635. Emerson's father was a Boston clergyman, and worthily continued the traditions of a long line of able Protestant ministers. Ralph Waldo was the third of seven children, and when but six years of age he had the misfortune to lose his father, who left his family in a straitened condition. To his mother and his aunt—both women of a superior order of intellect—the future philosopher was indebted for his early training. At eight years of age he entered the public grammar school, and shortly afterwards the Latin school. He gave a scholastic promise which was scarcely fulfilled, for at eleven he was a close student of Greek, and could turn Virgil into English heroic verse. He entered Harvard University, where he graduated in 1821, not, however, taking a distinguished rank; but he carried off a second prize for an essay in English, and was chosen class poet. After some experience as a schoolmaster, during which he studied theology under Dr. Channing at the Harvard Divinity School, he was ordained to the Unitarian ministry. In March, 1829, he became the colleague of the Rev. Henry Ware, minister of the Second Church in Boston. In the ensuing September he married Miss Ellen Louisa Tucker, who died without leaving any children in 1832. During this same year Emerson preached a sermon on the Lord's Supper which gave umbrage to his congregation. Notwithstanding the influence of Channing, he felt impelled to resign his charge, although he preached occasionally for some three years longer. Emerson visited Europe in 1833, and after a brief sojourn in France and Italy came to England, where he made the acquaintance of Coleridge, Wordsworth, and Carlyle. He was especially drawn towards Carlyle, and the seer of Craigenputtock and Emerson himself have left vivid descriptions of their meeting and of their conversations. On his return, Emerson settled at Concord (Massachusetts), and began to write

essays and to deliver lectures, chiefly on biographical subjects, in Boston and elsewhere. His first home at Concord was an old gambrel-roofed house built by his grandfather, and celebrated as the "Old Manse" of Hawthorne's story. In 1835 he married Miss Lydia Jackson, of Plymouth, Massachusetts, with whom he entered upon the new home where he peacefully remained for the rest of his long life. Emerson had begun a correspondence with Carlyle in 1834, and this correspondence continued for nearly 40 years. The deaths of his brothers Charles and Edward—young men of brilliant promise—exercised a profound impression upon Emerson, who sought relief in composition, and in gardening and other occupations of a retired country life. In 1836 he founded the Transcendental Club, and published anonymously his little work *Nature*, which dealt with such subjects as beauty, commodity, language, discipline, idealism, spirit, and prospects. The authorship of the book was at once recognised, but its sale was very small, only reaching 500 copies in twelve years. *The American Scholar*, an oration delivered before the Phi Beta Kappa Society of Harvard, marked an event in the literary annals of the United States, and it has been described as the "American intellectual declaration of independence." Emerson's *Address before the Senior Class in Divinity College, Cambridge, July, 1838*, caused a lively sensation in the religious world, and particularly among the Unitarians. The orator's position was extremely heterodox, and it was severely attacked by (among others) Professor Andrews Norton in an article entitled *The Latest Form of Infidelity*. The eight years from 1838 to 1846 were years of somewhat prolific production with Emerson, the following works appearing in the order named—*Ethics*, 1838; *The Method of Nature*, 1841; *Man the Reformer*, 1841; *Lectures on the Times*, 1841; *Essays*, 1842; *Essays*, 1844; and *Poems*, 1846. When Margaret Fuller and other Transcendentalists founded the *Dial*, Emerson became one of its contributors, and wrote for it regularly during its chequered existence of four years. He also took a tolerant, if slightly humorous, interest in the socialistic experiment at Brook Farm, sympathising to a considerable extent with the cultured but unpractical colonists. Emerson visited England again in 1847, and lectured in London, Manchester, Liverpool, and other towns. In the ensuing year he went over to Paris with Arthur H. Clough and W. E. Forster. On his return to America in 1849 he published one of his best-known works, *Representative Men*. These critical and biographical essays contained much of his finest writing. The author, after treating of the uses of great men, proceeded to discuss, with imaginative fervour and true philosophical insight, Plato the Philosopher, Swedenborg the Mystic, Montaigne the Sceptic, Shakespeare the Poet, Napoleon the Man of the World, and Goethe the Writer. These literary appreciations still retain their popularity. In 1852 Emerson published the *Memoirs* of his friend Margaret Fuller, Marchesa d'Ossoli, author of *Woman in the Nineteenth Century*, and other works. Another of his most popular works, *English Traits*, appeared in 1856. In this volume he recorded his

thoughts while visiting England and Scotland, and his sketches of life and character in the old country were very fresh and original. When describing his first visit to England he gave vivid reminiscences of Coleridge, Landor, Wordsworth, Carlyle, and other distinguished men. *The Conduct of Life*, another volume of papers partly philosophical and partly practical, was issued in 1860. Soon after the publication of this volume the American Civil War broke out. Emerson, like all Northerners, had a great detestation of slavery. He both wrote and spoke against it, and was a warm admirer of John Brown, of Harper's Ferry celebrity. He was an Abolitionist of the Free Soil party, and would have bought out the slave-holders. He admired the great self-sacrifices made in the interests of national union and for the abolition of slavery, and hailed warmly the manifestation of the national spirit at the close of the war. His own influence began to increase at this time. In 1867 he published his *May Day, and Other Pieces*; in 1870 *Society and Solitude*; and in 1871 *Essays*, and a volume entitled *Parnassus: Selected Poems*. Emerson's house was destroyed by fire in 1872, and during its rebuilding he paid a third visit to England and the Continent, remaining in Europe for about a year. After his return to the United States his mind never regained its early elasticity, and he suffered from frequent loss of memory; but he still returned at intervals to his literary studies, and in 1876 published his *Letters and Social Aims*. His closing years were marked by a calm serenity, and his death, which was very peaceful, occurred at Concord on April 27, 1882. In religion Emerson was a rationalist and an individualist, and in philosophy an idealist. All through life he was a courageous optimist, ever aspiring to find a wise and happy solution for the great problems of life. In nature and humanity he perceived ennobling influences for the elevation of the race and of the individual. He was possessed of an excellent sense of humour and a good judgment, and as yet America has produced no greater essayist or more original thinker. His poems are quaint and beautiful, but frequently irregular in form. A collected American edition of Emerson's works has been published in 11 volumes, and an English edition in 6 volumes. His correspondence with Carlyle has been ably edited by Professor Charles Eliot Norton, and an authoritative *Life of Emerson* has been written by James Elliot Cabot, the editor of his collected works.

Emery, an impure variety of corundum (q.v.) or sapphire, containing 60 to 80 per cent. of alumina and 8 to 33 per cent. of iron-oxide. It is grey or brown, sub-opaque and amorphous, with a hardness of 9 and specific gravity of 3.7 to 4.3. It occurs in schists, gneiss, and metamorphosed limestone, and in large boulders in a red soil, in Naxos and other islands in the Grecian Archipelago, and at several localities in Asia Minor, whence in all from 5,000 to 7,000 tons are obtained annually. It is packed in casks containing 4 to 5 cwt. each. After being crushed and sifted, it is either concreted into grinding wheels or hones, or stuck on to paper or

cloth, and is used for polishing plate-glass, crystals, and metals, and for cutting granites. Emery-wheels are made up of a mixture of emery-powder and vulcanised indiarubber; they are used extensively for smoothing and polishing iron-castings and for sharpening tools.

Emetics (Gk. *ēmeo*, I vomit), substances which produce vomiting, employed in medicine to get rid of some irritating or poisonous substance which has been taken into the stomach, and they are sometimes administered in cases of laryngeal obstruction (the act of vomiting promoting the expulsion of material blocking up the air passages). Substances given with the object of putting a stop to excessive vomiting are called *anti-emetics*. One of the simplest methods of producing vomiting is to irritate the fauces with a feather; warm water, mustard and water, brine and alum are reputed to possess emetic properties, but their action is very unreliable. The emetics upon which reliance is generally placed are such drugs as sulphate of zinc, ipecacuanha, antimony and apomorphia. Their action is apt to be attended with alarming symptoms, and they should never be administered save under medical advice.

Emigrés, a word generally used to designate those French royalists who quitted France at the Revolution of the 18th century, and took refuge in other European countries, where they supported themselves by teaching French, or other similar pursuits, and in many cases settled finally in their adopted country. Napoleon when Emperor gave permission for most of the exiles to return. The name is also sometimes applied to the Huguenot and other religious refugees.

Emir (also written *Ameer*), an Eastern word denoting "noble" or "princely," and originally employed to denote those who could claim descent from Mahomet or his daughter Fatima. Such emirs are to be found in Arabia, and in Turkey. They are entitled to wear a green turban, and form a kind of privileged nobility. Another use of the word is to denote the holders of certain high offices, and the Caliph himself is the Emir or Commander of the Faithful.

Emission Theory of Light, known also as the corpuscular theory, was that light consisted of extremely refined particles of material nature projected from the luminous body. If it struck certain substances it rebounded without entering; those were called opaque substances. If, on the other hand, the material was transparent, it possessed the property of allowing the light corpuscles to enter. The distinguished advocacy of Newton retarded the death of this theory and the advance of the true wave-theory of light. He explained the ordinary laws of reflection and refraction, certain phenomena of interference of light, and other observed effects, by the most ingenious assumptions of properties possessed by the light particles; but Fresnel and others by repeated experiments in diffraction and like branches of the subject cleared away the difficulties that had presented themselves to the wave-theory, and the 19th century saw the complete adoption of the latter.

Emmett, ROBERT (1783-1803), was an enthusiastic Irish patriot of estimable qualities but unfortunate life. He was born in Cork, and studied for the bar at Trinity College, Dublin, but was expelled for his political views. Falling under the suspicions of the Government, he left Ireland during the suspension of the Habeas Corpus Act, but afterwards returned, and became a member of the Society of United Irishmen. For his share in the rebellion of 1803 he was arrested, tried, condemned, and executed. His attachment to Miss Sarah Curran caused much embarrassment to Curran (q.v.), and gave occasion for Tom Moore's ballad, *She is far from the land where her young hero sleeps*.

Emotions, in *Psychology*, one of the three great classes of mental states. An emotion is analysable into a set of feelings (pleasant, painful, or neutral) combined with presentations, popularly called ideas. The feelings impel action towards or away from the objects these represent, so that emotion is (in the developed mind) the link between thought and volition. Emotions are thus motives to action, and it is in proportion to his habit of subordinating his emotion to the regulative faculty that a man ranks higher or lower in the scale of reasonable beings. By their physical effects the emotions are classed as pleasurable or painful.

Empedocles, a Greek philosopher and poet, born in Sicily in 460 B.C. He was greatly revered by his fellow-citizens, who wished to make him king, but were persuaded by him to adopt a democracy. He was looked on as a prophet, a magician, and the apostle of liberty, and his life was rendered more interesting by the manner of his death, since tradition represented him to have fallen into the crater of Mount Etna. As a philosopher he held almost Pythagorean views, taking as the foundation of existence the four elements—earth, air, fire, and water—and the antagonistic principles of love and hatred. His philosophic views were embodied in vigorous verse, in a style imitated at a later period by the Latin Lucretius.

Emperor, the highest rank among sovereigns, the name being derived from the Latin *imperator*, which has in German been rendered as *Kaiser*, in Russian *Csar*, from the subordinate Latin title *Cesar*. The word, which strictly meant holder of the supreme power, was bestowed, under the republic, as a title upon victorious generals. After the fall of the republic the name was applied to the supreme ruler, and eventually became his most usual title. It was especially associated with military power. It was lost in the West, though long retained in the Byzantine empire, but was revived at the restoration under Charles the Great of the Holy Roman Empire. The Emperor then had theoretically the same ascendancy politically as the Pope spiritually—an ascendancy often disputed, and never fully admitted. Napoleon adopted the title of Emperor in this sense of ascendancy, and the German Empire of the present day involves the same fundamental idea, as does also the King of England's title of Emperor of India, and the expression "Imperial Parliament."

Emperor Moth (or *Saturnia carpini*), a large moth interesting as the only British representative of the *Saturniidae*, the family which includes many of the best-known of the silkworms and the great Atlas moths. The English species has large brown fore wings which measure more than two inches in expanse: the hind wings are yellow. The larva, which is green dotted with pinkish spots, is most commonly found on heaths.

Emphysema, a term applied to an unnatural accumulation of air in some tissue of the body. In wounds of the chest wall, where the lung is injured and air escapes into the textures surrounding the damaged parts, a condition which is spoken of as surgical emphysema is produced. Emphysema proper is a peculiar affection of the lungs in which the air cells become dilated. On examination of an emphysematous lung a number of blebs are seen to project from its surface, and on throwing the diseased organ into water it is found to possess an unnatural buoyancy due to the distension of its vesicles with air. Emphysema is very apt to occur in association with repeated attacks of bronchitis; indeed, in this connection, it is one of the commonest diseases met with in persons beyond middle age. The symptoms produced by the condition are shortness of breath, duskiness of the skin due to deficient aëration of the blood, and often some degree of emaciation. Long-standing emphysema usually affects the heart by interfering with the circulation of blood through the lungs. The treatment of emphysema mainly resolves itself into dealing with the associated bronchitis; taking every precaution against cold, careful dieting, and in some cases removing the patient to favourable atmospheric surroundings.

Empirical Formulæ, formulæ which simply express the chemical composition of a substance without any attempt to indicate the mode in which the atoms are united in the molecule—e.g. alcohol C_2H_6O , glycerine $C_3H_8O_3$, etc.

Empiricism, in *Philosophy*, a general term for systems based on the doctrine that all knowledge is ultimately derived from experience (Gk. *empeiria*), without any innate element. The name is often used in medical science as a term of reproach almost synonymous with *quack*, though strictly speaking all medical and surgical science is empiric and is valuable just in so far as it is founded upon observation and experience. But the medical empiric (a "bone-setter" is a good example) usually knows only a limited set of facts, but not the principles discovered by past experience.

Empyema, a collection of pus or matter in the pleural cavity. Inflammation of the pleural membrane [PLEURISY] is at times attended by the pouring out of fluid (pleurisy with effusion), such fluid may be serous or purulent. In the latter case the condition is said to be one of empyema. When matter forms in this way within the chest it is, as a rule, hopeless to expect a cure unless an exit is afforded for the pent up pus. Sometimes the matter bursts into one of the air tubes, and is discharged by the mouth, more commonly it finds its way through

the chest wall. The aim of the physician is to secure the evacuation of any collection of matter which may form at the earliest opportunity, and not to subject the patient to the tedious and exhausting process which is implied if the pus be allowed to find its own way to the surface. Inflammatory affections of the pleura in children are particularly apt to result in empyema. Treatment consists in removing matter by means of an aspirator, or in making a free opening, under antiseptic precautions, through which the pus may discharge.

Emu. 1. A river of Germany, rising in the S.E. of the Teutoburger Wald in Lippe Detmold; it flows N.W. through Rhenish Prussia and through the W. of Hanover, falling into the Dollart See near Emden. It has a course of 234 miles, and is navigable on the tide for 13 miles to vessels of 200 tons. A canal unites it to the Lippe and so to the Rhine.

2. A Prussian town of Hesse-Nassau, on the Lahn, and a well-known watering-place from the 16th century onwards. The water is warm—from 70° to 118° Fah.—and saline, and is considered beneficial in cases of catarrh and gout, and in affections of the lungs, stomach, or kidneys. It is highly charged with carbonic acid. The annual visitors average 8,000, and much water is bottled for export. Here took place the memorable interview between the King of Prussia and Benedetti in 1870.

Emu, any bird of either of the two species of the Ratite genus *Dromæus*, confined to Australia. They belong to the same family as the Cassowary (q.v.), from which they differ in having no casque, or wattles; the head and the neck are feathered, and the toes furnished with stout-curved nails. The wings are rudimentary, but their powerful legs enable these birds to run with great speed. The height is about six feet, and the plumage shades of dull brown, the lightest hues being beneath. The common emu (*D. nova-hollandiæ*) is widely distributed over the whole of Australia, and is much hunted for its flesh, which is said to resemble beef, and this fact and the fondness of the natives for its eggs have greatly reduced its numbers. The Spotted Emu (*D. irroratus*) is confined to Western Australia, and has been partially domesticated in Surrey, breeding readily in confinement. In both the species true pairing occurs.

Emulsin, a substance occurring in sweet and bitter almonds. It possesses the power of acting as a hydrolytic agent, causing the decomposition of the *amygdaline*; also present in grape sugar, prussic acid, and benzaldehyde. [BITTER ALMOND OIL.]

Emys, a genus of Marsh Tortoises, with 64 species, chiefly Oriental and American. *E. europæa* is the Common Marsh Tortoise of Southern Europe, North Africa, and Western Asia.

Enamel. [TOOTH.]

Enamels are vitreous coatings applied to the surface of pottery or metals, though the name is sometimes restricted to the latter case only. The

vitreous coating is generally an easily fusible glass—often a lead glass—containing oxide of tin, or other substance, to render it opaque. In the case of enamelled culinary articles, lead glass is unsuitable, and should never be used, a potash or soda glass being best employed. Coloured glasses are obtained by the addition of different metallic oxides. When obtained the glasses are finely powdered, spread over the surface to be enamelled, and fused on. In the case of pottery the fusion takes place easily, but the enamelling of metals is not so readily accomplished. Enamels are chiefly employed for ornamental and artistic purposes, and also as a protection for metals, to prevent them oxidising, etc. Thus for the latter purpose they are largely used as a coating for the interior of saucepans and kitchen articles, baths, sheet iron for advertising purposes, etc. Enamelling for ornaments is an art of great antiquity, and examples have been found from the prehistoric ages, while it is known to have been practised by the Egyptians and Assyrians several centuries B.C. The analysis of coloured enamels of these times has also shown that they used the same substances for colouring the glasses as are now generally employed. Examples of Roman enamelled work are existent, but the art attained to its greatest popularity in the Middle Ages. Various modes of ornamentation were employed, as *Champ Levé*, much practised at Limoges, which from the 12th to the 14th centuries was the chief seat of the art. In this the pattern was engraved on a sheet of metal, the parts to be enamelled being hollowed out, and the hollows filled with the enamel, fused, and afterwards ground and polished. *Cloisonné*, the style of the Byzantine school, which flourished during the 10th century. The design is traced by thin bands of metals, frequently gold, fixed to the metallic base, the space between the bands being filled with the enamel. This method is also much employed at the present time in Chinese and Japanese ornamentation. During the 13th century translucent enamels were largely used, chiefly in Italy. The design was engraved on the metal, usually silver or gold, and the enamel applied so that its varying thickness produced the shades necessary. Afterwards enamels were largely employed for the purpose of surface painting. In the earliest style, Limoges, 16th century, the metal was covered with a dark enamel, upon which the painting was done in light colours. In the latter style, which flourished much in England and Paris, a white opaque enamel was laid upon the plate, and the painting was executed in coloured enamels mixed in a suitable medium, each colour being separately fused. This was very popular during the 18th century for miniature trinkets, watch-cases, snuff-boxes, and other small articles, though in England larger works were often done in enamel.

Encephalocoele (from two Greek words signifying a brain tumour), a condition of rare occurrence in young infants, in whom a protrusion of the cranial contents takes place through some imperfection in the limiting walls of the skull.

Enchondroma, a tumour consisting of an abnormal cartilaginous outgrowth. [TUMOUR.]

Encina, JUAN DEL (1468-1534), a Spanish dramatist, born at Salamanca or at Encinas. He was educated at Salamanca, and then went to Madrid, where he entered the household of the Duke of Alba. In 1492 he began to write comedies, and in 1496 published some dramatic and lyric poems. He went to Rome, and took orders, and became *maestro di capella* to Leo X. A farce published by him in 1514 is lost. In 1519 he went to Jerusalem, and published a verse account of his journey. He soon after returned to Spain, as Prior of Leon, and died at Salamanca. The poems mentioned above are an interesting link between the old Mystery Plays and the later drama.

Encke, JOHANN FRANZ (1791-1865), a German astronomer, was born at Hamburg. He studied under the astronomer Gauss at Göttingen, and during the War of Liberation served in the artillery from 1813 to 1815. He was then appointed assistant in the observatory at Seeburg, and here it was that he calculated the orbit of the comet now bearing his name, predicted the times of its re-appearance, and discovered an acceleration in its motion. In 1825 he became director of the observatory at Berlin, a post which he retained till death. Besides many papers in astronomical transactions, he wrote in 1822 *Die Entfernung der Sonne*, and in 1823 *Der Venus-Durchgang von 1769*.

Encyclical, a term used to denote a circular letter addressed by a religious superior to those in his charge. The name is now generally restricted to a letter issued by the Pope to the Bishops of the Roman Church, and embodying the Papal opinion or decision upon some point of faith, morals, or discipline. It was a favourite instrument of the late Pope (Leo XIII.), just as the Allocation was the instrument preferred by Pope Pius IX.

Encyclopædia, a barbarous Greek compound, denoting originally, according to its etymology, the circle or round of knowledge that constituted an ordinary liberal education. Later the name came to be employed to a kind of compendium of general knowledge, or of the special knowledge existing of any particular branch or subject. The *Summa Theologica* of St. Thomas Aquinas is an example of the second kind of encyclopædia, while the earliest general work of the kind was the *Speculum Historiale, Naturale, Doctrinale, Morale*, begun and almost finished by a Dominican monk, Vincent of Beauvais. Francis Bacon designed a scientific encyclopædia in his *Novum Organum*, and there have been many since, both general and special, among which may be mentioned the *Encyclopædia Britannica*, with its ten editions; the *Encyclopædia Metropolitana*, in which S. T. Coleridge wrote upon *Method*, and Whately wrote the articles on *Logic* and *Rhetoric*; and Larousse's *Dictionnaire*.

Endemic (derived from two Greek words, *en*, in; *demos*, a people), a term applied to diseases which are definitely associated with particular peoples or particular localities. The word is used in contrast to the word epidemic, the latter being applied to those diseases which spread widely

and are not confined within narrow geographical limits. The best example of an endemic disorder is afforded by malaria or ague, this disease displaying, as a rule, a partiality for those living in particular situations, such as the marsh lands in the tropics, the deltas of rivers, and the like.

Endive (*Cichorium Endivia*), a hardy annual plant belonging to the *Compositæ* and closely related to the Chicory (q.v.). It is indigenous in North China; was used as an esculent by the Egyptians at an early period; is mentioned by Ovid and Pliny as being so employed by the Romans; and was cultivated in England in 1548. It produces a cluster of large, sinuate, smooth-toothed leaves, either broad and slightly torn as in the Batavian variety (*C. E. latifolia*), or narrow and finely curled as in the variety *crispa*. The leaves are bleached either by being tied up or by being covered by a pot to reduce their bitterness of taste, and are then used in salads and stews. The flower-stalk grows two feet in height, and bears heads of pale blue ligulate florets. Endive may be sown, under glass, in January; or, in the open, from April to August, the plants being thinned, planted out when a month old, and bleached for 10 to 30 days before gathering.

Endocarp, the inner layer of the fruit, most correctly applied to such cases as the "stone" of the drupe, as in the cherry, plum, peach, etc., or the "shell" in the cocoa-nut, where there are three distinct layers all formed from the carpels or true gynoecial structures and not from the floral receptacle. The three layers are the *epicarp*, *mesocarp*, and *endocarp*, and are known collectively as the *pericarp*.

Endoceratidæ, an extinct family of Cephalopoda, including *Endoceras*, a genus remarkable as the siphuncle (q.v.) is protected by a thick tube formed by the septa being prolonged backwards around it. *Endoceras* is found only in the Lower Silurian (Ordovician), except one doubtful species, but its ally *Piloceras* also occurs in the Cambrian.

Endochrome, a term once used for the protoplasm and other contents of the plant-cell, especially when coloured by chlorophyll or other colouring-matter. It is now practically confined to those plates of protoplasm in diatoms (q.v.) which are coloured brown by diatomin.

Endodermis, or BUNDLE-SHEATH, a layer of cells outside the fibro-vascular tissue of the stem or root of some plants, commonly containing starch-grains.

Engamy. [MARRIAGE.]

Engogens, a name formerly applied to Monocotyledons (q.v.) from the erroneous notion that in this class of flowering plants the growth in thickness of the stem was *endogenous*, or from without inwards, in contradistinction to that of Exogens (q.v.). The origin of roots is correctly termed *endogenous*, since they are formed internally and force their way out through the outer layers of tissue.

Endoparasites are parasites which live within the body of the host, such as the tapeworm within a dog. A second group of parasites, including the fleas and ticks, live on the surface of the host, hidden in its fur, etc.; such are known as ectoparasites.

Endophagy. [CANNIBALISM.]

Endoplasm, the more granular inner portion of the protoplasm of the plant-cell, in which the chlorophyll-granules are suspended. In the rotatory movement of the protoplasm, such as is seen in *Elodea* or *Vallisneria*, this layer alone moves.

Endoplast is the term now generally employed for that part of a cell previously known as the nucleus.

Endosmose, in *Physica*, signifies the passage of a fluid through a membrane or other porous partition, there being another fluid on the other side. This is illustrated by the endosmometer, which consists of a glass tube at one end of which a membranous bag is fixed. If the bag be then filled with milk and immersed in a vessel of water it will be found that the liquid within the instrument gradually rises to fill the tube, and the water-level outside gets lower. This is due to a process of diffusion of each liquid through the membrane; but more water passes in than milk passes out, and there is a resultant rise of level inside. The inward flow to higher level is called *endosmose*, and the smaller outflow to lower level is called *exosmose*. For the action to take place it is necessary that the liquids should be capable of mixing, that they should be of different densities, and that the membrane should permit at least one of the liquids to flow through. The rate of diffusion depends on the substance in solution, on the strength of the solution, and on its temperature. A similar piece of apparatus, with a porous earthenware jar instead of the membrane, may be used to exhibit similar effects with gases. [DIFFUSION, OSMOSE.]

Endosperm, a term applied to tissues within the seed of flowering plants, or in the macrosopore of *Selaginella* (q.v.), which in all cases serve to nourish the embryo; but which are probably not of homologous origin, so that the term is somewhat ambiguous or not morphologically precise. In *Selaginella* it is a large-celled tissue formed by free cell-formation below the diaphragm at the base of the prothallium, and it has been termed the secondary prothallium or metasperm. In Gymnosperms it is similarly formed within the embryo sac (whence its name), but before fertilisation, the archegonia being formed on it, so that it is apparently a primary prothallium or archisperm. In Angiosperms it does not originate until after fertilisation, when the secondary nucleus of the embryo sac undergoes repeated division, and so forms this tissue, which seems here, as in *Selaginella*, to be a metasperm. None is formed in orchids, and but little in Alismaceæ. In many seeds it is absorbed by the embryo before the seed is ripe (exalbuminous); but in others, including most monocotyledons, it remains (albuminous), and is only absorbed during germination. [ALBUMEN.]

Endostyle, the term given to the cartilaginous rod of *Amphioxus* (q.v.), and the thin line along the ventral side of the branchial cavity of the Ascidians (q.v.). It is regarded as the representative of the vertebral column of the vertebrates or the cartilaginous notochord of the other Chordata (q.v.).

Endymion, according to one legend, a Greek shepherd who was beloved by Selene (the Moon), who put him to sleep on Mount Latmos in order to enjoy his company. His sleep is also said to have been inflicted by Zeus as a punishment for falling in love with Here, or in answer to his prayer for eternal youth. The legend forms the subject of Keats' charming poem, *Endymion*.

Enema, or **CLYSTER**. Drugs and nutrient material are sometimes administered by injecting them into the lower bowel. Such an injection is termed an *enema* (from a Greek word signifying to inject). A simple enema prescribed with the object of emptying the lower bowel in constipation usually consists of warm water, or soap-and-water, with the addition sometimes of castor oil. Nutrient enemata are given where food cannot be retained when administered by the mouth; or where, as in stricture of the oesophagus, there is a difficulty in swallowing, and consequently in the passage of nutrient material from the mouth into the stomach.

Energumen, one possessed by an evil spirit. [DEMONOLOGY.]

Energy does not admit of a very satisfactory definition. It is usual to regard it as that property possessed by material bodies in virtue of their position or of their motion, by which resistance may be overcome. Energy of position is called *potential*; energy of motion is called *kinetic*; and all manifestations of energy may without great assumptions be classified as potential or kinetic. Taking a simple example of energy due to motion, a cannon-ball of mass m travelling with speed v , possesses an amount of kinetic energy that will enable it to perhaps penetrate a solid screen of iron or wood. It certainly presents a case of motion against resistance, for which energy is required. To measure its energy the simplest plan is to regard it as being given to the ball by a definite force acting on it for a definite distance. The energy necessary to do this is measured by the product of the force and distance; a small force would require a great distance, and conversely. Newton's laws of motion help in working this out, and give us the result $\frac{1}{2}mv^2$ as a measure of the energy due to the motion of the ball. Suppose this ball to be projected up vertically, in direct opposition to the force of gravitation on it. Then it is again effecting a motion against resistance, and because its supply of energy is insufficient its speed will, after a time, become zero, and the ball remain for a moment motionless. It has in this position no energy of motion, but being so placed in relation to the earth that it may be attracted and put in motion, it is said to have potential. This is also measured by the amount of work done in bringing it to that position; if h is the height it reaches and w its weight, then wh measures its potential energy.

If it is now allowed to fall, the force w acting through the distance h gives just so much kinetic energy ($\frac{1}{2}mv^2$) to the body as it lost previously in rising through the same height against the same force. Both forms of energy may be expressed in the same units, because they are convertible the one to the other. The ordinary engineer's unit of energy or of work is the *foot-pound*, which is the amount of energy required to exert a force of 1 lb. weight through a distance of 1 foot.

The principle of *conservation of energy*, applicable to all its modifications of kinetic or potential, states that in any given system the amount of energy must remain constant unless it gives or takes from external systems. There may be transformations from one form to another in the system, but no change in total quantity. Any expenditure of energy to produce motion against resistance—i.e. to do work—merely means therefore a redistribution of energy, and work may be defined as the transformation of a certain amount of energy.

Certain motions exhibiting kinetic energy, or arrangements exhibiting potential, are obvious to the sight because of their appreciable magnitude; thus we have—

(a) *Visible kinetic energy*, as of a cannon-ball in motion, or of a spinning-top.

(b) *Potential energy of visible arrangement*, as of the cannon-ball at its highest point, a coiled-up spring, or of an elevated cistern of water, each of these being able to "run-down" to a lower potential, and do work in the process.

(c) Alterations of the above two forms, as of a swinging pendulum, or a vibrating rod such as a tuning-fork. Then there are other forms of energy which manifest themselves in much smaller linear dimensions, though perhaps they are as readily obvious to the senses.

(d) The alternating energy of a *hot body*. Such a body is understood to have its molecules in some sort of oscillatory motion; this, therefore, corresponds with c .

(e) The alternating energy of *radiation*. This is possessed and transmitted not by material particles, but by the ether; and it is here that exception might be taken to the definition of energy given at the beginning of the article, which stated that it was a property possessed by material bodies. But though ether is not material in the ordinary sense, yet it is regarded as possessing one property characteristic of matter; it is believed to have *mass*, and any alternating motion in ether implies its possession of a certain amount of energy.

Radiation probably includes all forms of energy that are transmissible through ether. Thus, radiant heat and light come under this head; also electromagnetic radiation, which differs only in degree and not in kind from the other two. The energy of electricity in motion along a conductor may consist of energy of radiation, and of an alternating energy of material particles. [HYSTERESIS.] If the conductor has any resistance, part goes to heat.

(f) *Potential energy of separation*. This is analogous to b , but is intended here to represent molecular separation. Two particles may have an affinity for each other—i.e. a tendency to combine

and lower their potential energy. Work has to be done to separate them, whether their attraction for each other is due to the existence of opposite electrical charges on each, or to the doubtless similar chemical affinity of one for the other. In fact, this applies to all cases where separation causes strain in the system.

These different forms of energy are thus all cases of potential or kinetic; it is conceivable that even this division may be avoided, and that potential energy may be shown to be energy of motion, or that kinetic energy is energy of position.

A steam-engine offers a good instance of transformation of energy. Coal and oxygen uncombined possess a store of potential, though in contact they may not at once unite, just as a loose stone may be kept high up on a mountain without approaching the earth more nearly. But as in the latter case the energy of a little push may start the change of energy of the loose stone, so with the coal the energy of a little heat at high temperature may start its change. The burning coal gives heat energy, and this is more or less efficiently applied to heat water in the boiler of the engine. The water is converted into steam, and this, possessed of energy derived from the coal, is able in the steam-cylinder to produce motion against resistance. A piston receives a reciprocating motion, and transfers the energy to the rotating parts of the engine. If the engine is a locomotive, its energy of mechanical motion will drive a train along a railroad at a definite rate, again overcoming resistance due to air, friction, etc. The speed of the train being constant, no increase of its kinetic energy takes place, and the whole supply of energy from the steam goes to overcome the external resistances. In doing this the air is swept into eddies, whose motion gradually dissipates in heat, and any surfaces where friction is acting will also become warmer. A certain amount of noise is created, which means wave-motion in the air, which on account of air-friction gradually dies away and produces further heat. Thus many transformations occur, some of which have not been mentioned, but the total amount of energy is the same at all times, though its distribution is so different.

But though any one form may be directly or indirectly converted to any other form, it may not be all so converted. A system may have an amount of energy, but not all of it will be available for certain transformations. The second law of thermodynamics, for example, states that no engine can produce mechanical motion from heat energy, unless a difference of temperature exists somewhere in the system. In other words, the heat-energy in a system, however great its quantity may be, cannot supply mechanical motion, unless its distribution is irregular. Likewise with the energy of electrical distribution, a difference of potential is necessary for the production of mechanical motion. But a difference exists between these two cases; in the latter a perfect engine could convert the whole of the electrical energy into kinetic, because zero potential may be practically obtained, whereas a perfect heat-engine working within the available limits of temperature, and not using the absolute

zero of temperature, cannot possibly convert all the heat into kinetic energy that is given to it. So when energy fritters away in heat, a portion is irrecoverable; and almost every conversion of energy involves some loss in heat. These considerations lead to the doctrine of the *dissipation of energy*, that the energy of the universe tends to degenerate to heat, and that this tends to become uniformly distributed and so render the available energy zero.

Enfantin, BARTHÉLEMY PROSPER (1796-1864), a French theorist and social reformer, was born at Paris. In 1813 he entered the École Polytechnique, but had to leave Paris for joining in the defence of the city against the Allies. For some time he was a commercial traveller in different Continental countries, but in 1823 he set up in business at Paris, and in 1825 made the acquaintance of St. Simon, who made him the heir of his visionary schemes. When the Revolution of 1830 occurred Enfantin declared his programme, among his principles being communism, with temporary as well as permanent marriage, and the abolition of inheritance of property. [ST. SIMON.] He organised a model community, which failed owing to a quarrel with the director of the political part of the programme. He then established a kind of convent at Menilmontant, of which he became "le Père," but this was suppressed by the Government in 1832, and he was punished as an offender against public morals. His next step was to start a colony in Egypt. This failed, and he reappeared in France as a farmer. In 1841 he was appointed one of a commission to Algeria, and he wrote a work upon colonisation in Africa. He afterwards received an appointment upon the Lyons and Mediterranean railway, and passed the rest of his life in obscurity.

Engadine, a Swiss valley in the Grisons, on the banks of the Inn, bordering on Tyrol, and much loved of tourists for its picturesque villages and beautiful scenery. It is 50 miles long, of varying width, and is divided into the Upper and Lower Engadine. There are mineral waters. Many of the inhabitants migrate to make money, and then come home to live. The language spoken is called Ladin or Romanisch.

Enghien, LOUIS DE BOURBON, DUC D' (1772-1804), son of Louis Condé, Duc de Bourbon, was born at Chantilly. At the Revolution he left France, and travelled in Europe. In 1792 he was in Flanders with the army of his grandfather, the Prince de Condé, and later commanded the vanguard in the war which ended in the peace of Lunéville in 1801. He then lived at Baden in retirement, and married the Princesse de Rohan Rocheforte. When Cadoudal's conspiracy (q.v.) happened the Napoleonists suspected the Duke of Enghien of having visited Paris. The mysterious visitor was really Pichegru. By a violation of territory Napoleon captured him in Baden, and he was brought to Strasburg and then to Vincennes, where he was shot. There is some doubt as to how far Napoleon was personally responsible for his death.

Engine, the generic term for any converter of energy from one form to another. Such arrangements are very numerous and widely different in principle and construction. Hence their classification brings the study of special examples under totally different headings. Thus the conversion of the heat-energy in steam to mechanical motion is effected by the *steam-engine*; the heat is supplied by the chemical combination of coal, petroleum, or other such fuel, with oxygen. The similar conversion of the heat-energy in the products of combustion of coal-gas is effected by the *gas-engine*; and of the heat-energy in hot air by the *air-engine*. Such engines producing mechanical motion are termed *prime-movers*, a term which also includes water-wheels and turbines. Such may further be classified as stationary or locomotive engines, the former including all those that remain in the same place giving rotatory or oscillatory motion to various mechanisms, and the latter all those that supply the energy for their own transference and perhaps that of a train of dependent carriages.

Engineering is the art of construction. As a profession, or class of professions, it includes metal-working and machine manufacture; the design and construction of roads, railways, canals, harbours, and docks; the building of bridges of wood, masonry, or metal; of masonry or earthwork embankments and dams; of trenches and military fortifications; the design and carrying out of systems of water supply, including storage, transit, filterage, etc.; of systems of drainage, irrigation, and sewerage; and, lastly, the production of electrical power and its disbursement, the construction and working of electrical instruments and of dynamo-electric machinery of all kinds. Thus the distinct professions in engineering are numerous: military, mechanical, civil, marine, hydraulic, hot-water, gas, mining, locomotive, sanitary, chemical, and electrical engineering. All these require special training, and the whole field is too vast to be within the grasp of one individual. The mechanical engineer has the greatest technical knowledge; he understands the nature and behaviour of materials, the method of their treatment, and their applicability to various structures. His knowledge of weak points in structures, the wisest modes of strengthening them, and of the plans to be adopted at the crises when they fail, is entirely practical and derived from experience that the highest theory could not with confidence teach him. Nevertheless, he cannot move onwards without theory; the principles of dynamics, physics, and mathematics are all-important to him, and if not sufficient to explain all his practically-acquired facts, they at any rate support such facts and enable him to predict others. Every engineer should if possible have a certain probation as a mechanic; those who have so served are taken in preference even where their intimate knowledge of handicraft and material are of no direct use. Such a knowledge is becoming more important every year in electrical work, which in its great advances must go hand in hand with mechanical engineering. Civil engineering may not in many connections

demand much of this special technical knowledge, as, for example, in the laying-out of railways, or the construction of simple roads, canals, or other waterways. But even in these the mechanical engineer comes to the front, as when heavy bridge-work occurs on the road or railway, and aqueducts, locks, or sluices on the waterways. The ideal course for any engineer who is to design and construct at all should involve two years' theoretical work in mathematics, physics, chemistry, and engineering, and three years' practical training in some works, after which he should specialise in the one industry that he means to make his own.

Engineers, as a military term, used to denote that part of an army which occupies itself with the making of bridges, fortifications, and other military constructions, and prepares plans and surveys. In the British army the Corps of Royal Engineers consists of 40 companies, and undertakes among its other duties the execution of the Ordnance Survey. The non-commissioned officers and privates of the Royal Engineers receive a higher rate of pay than the ordinary infantry, and are for the most part recruited from among skilful artisans. The word is also used in the navy to designate those officers of a steamship who have the charge and management of the engines. The word has also a further and wider signification, in which it is equivalent to what the French call *mécanicien*, an engine-driver, and our English use of it in several distinct senses often puzzles foreigners.

England. Physical Features. The name England is often used as a political term to denote the united kingdoms of England, Wales, and Scotland, the three divisions of the largest island in Europe, which rises from a submerged plateau stretching from the Bay of Biscay to the N. of the Shetland Isles. Geographically, however, it is only applied correctly to that part of the island which lies S. of Scotland and E. of Wales, extending from lat. $90^{\circ} 48'$ to $55^{\circ} 45'$ N., and from long. $1^{\circ} 45'$ E. to $5^{\circ} 44'$ W., and covering an area of 50,823 square miles. Of this country the northern and south-western districts are of a mountainous character, the remainder, about two-thirds of the whole area, consisting of plains broken occasionally by low hills. One of the most marked physical features is an unusually long and indented coastline affording excellent harbours, by means of which England, situated advantageously between the German and Atlantic Oceans, is able to command the trade alike of east and west. The climate, with a heavier rainfall on the W. than on the E., is milder, on the whole, than that of any region in the same northern parallel. The soil is rich in minerals. The tin mines of Cornwall, a county which still produces both tin and copper, were worked in the earliest period of which we have a record. The coal fields, most of which yield iron as well as coal, cover an area twice as large as that of Yorkshire. They extend over Northumberland, Durham, parts of Lancashire, Yorkshire, and Staffordshire, and the neighbourhood of Bristol. Lead, slate, building stone, and salt may also be mentioned among the natural productions of the country.



PHYSICAL MAP OF ENGLAND AND WALES.

Industries. Thousands of men are engaged in mining. The smelting of iron is carried on most largely in the Cleveland district of Yorkshire, of which the chief town is Middlesborough, and at Barrow in Lancashire. Iron goods are produced in Birmingham, Wolverhampton and the neighbourhood, and cutlery at Sheffield. Lancashire imports cotton at Liverpool for use in the mills of Manchester and the towns near it. In the West Riding of Yorkshire woollen goods are made, especially at Leeds and Bradford. Pottery is manufactured in a district of Staffordshire, called "the Potteries." Ship-building is extensively carried on in London, Liverpool, Jarrow, and other ports. Agriculture is practised in the rural districts, which may be said to lie S. of a line drawn across the country from Devonshire to Hull, to the N. and W. of which the manufacturing and mining districts are mainly confined. Within the region of agriculture, hops are cultivated in Kent and Worcestershire for use in the breweries in the preparation of the national beverage, beer.

Imports and Exports. The imports consist mainly of articles of consumption, such as animals for food, preserved meats, corn, coffee, tea, sugar, fruit, wines, tobacco, etc.; and of raw materials for manufactures such as cotton, wool, timber. The exports are mainly of articles manufactured in the country—cotton, woollen, and linen fabrics, iron goods, etc.

Population. A country with such industries is necessarily populous in spite of a continuous drain through emigration to the Colonies. By the census of 1901 England, apart from Wales, was shown to have 30,811,687 inhabitants.

Religion. There are upwards of 250 sects in the country, and a large number of people who stand aloof from all religious bodies. The Church of England, however, is still established legally. It has two archbishops and thirty-five bishops, each of whom presides over a diocese. Each diocese is mapped out into parishes, in every one of which is a resident vicar or rector. [ENGLAND, CHURCH OF.]

Justice is administered by magistrates in the first instance, for the punishment of trifling offences, and in County Courts (q.v.) for the recovery of small debts, etc. The more serious cases are tried in the High Court of Justice, which has two divisions—the Chancery and the King's Bench. The judges of the King's Bench try criminal as well as civil cases, not only in London, but in various towns on fixed circuits, which they visit three times in the year. In most cases they have the assistance of a jury (q.v.). Civil cases can be carried to the Appeal Court, and ultimately to the House of Lords, which, as an appellate tribunal, consists of such peers as hold, or have held, high judicial office. In certain cases persons convicted on indictment may appeal to the Court of Criminal Appeal. [APPEAL.]

Army and Navy. As the policy of England has long been unaggressive, and as an insular position is in itself a safeguard, there is no need for a vast standing army such as drains the resources of the Continental powers. The navy is maintained with special care, not only for the defence of the mother country, but for the protection of the various parts

of the British Empire. (For details see ARMY, NAVY.)

History. Little or nothing, except as to their physical characteristics, is known of the people who preceded that Celtic race which we call "the Britons." These Britons were found by the Romans, who first attacked the country under Julius Cæsar in 55 B.C. In the course of the next century the Britons were forced to submit to the Roman rule, which was maintained by means of roads intersecting the country from N. to S. and from E. to W., and thus affording easy communication between the towns and fortified camps of the conquerors. During the period of Roman rule the Britons advanced in civilisation and formed a British Christian Church. In 410 A.D. the Roman legions were withdrawn, and the natives, long unused to self-protection, were left a prey to the tribes of Teutons, who now came from their home in the lands about the mouth of the Elbe, to settle in a country with whose wealth they had long been familiar through their predatory expeditions. As to what was the actual fate of the Britons during this new conquest, history is silent. Perhaps they were exterminated, probably they were enslaved, and by intermarriage with their masters gave some tincture of their blood to the future inhabitants of their land. The only marks which they have left on the language and literature of their successors are the legends of King Arthur, a few geographical names, and some common words such as "clout," "mattock," "mop." It was, however, only on the plains that the destruction was carried out. In the highlands of Cornwall the Celtic language only died away at the end of the 18th century, while it still lingers among Celtic peoples in the mountains of Wales and Scotland, just as it does in Man, Ireland, and Brittany.

The Teutonic or German invaders were divided into three tribes, the Jutes who settled in Kent, the Saxons, whose name survives in the last syllable of Essex, Middlesex, and Sussex, and the Angles who, having conquered the land from Essex to the Forth, finally gave their name to the whole country. All came fierce by nature, and doubly fierce with a warriors' creed. They looked forward with eager expectation to an immortal life of fight and feast among gods whose names still linger with forgotten meaning in the titles of our days of the week. But soon Augustine, a Roman missionary sent by the Pope in 596, arrived in Kent, and converted its king and people. Paulinus, his follower, became the evangelist of Northumbria. A Christian Church was thus just founded, when it had to meet two dangers—a danger from the forces of heathendom under Penda, King of Mercia, and a danger from a rival Church. The conversion of the North had been largely due to teachers who derived their doctrine from the Irish Church, which differed in certain points from that of Rome. A conference was held at Whitby in 664 A.D., with the result that the Roman usages were accepted. From this time the spiritual authority of the Pope was scarcely questioned in England until the Reformation, although, as we shall see, the English spirit of independence frequently protested against his interference in temporal matters.

It was long before the various tribes coalesced

into a single nation. The little kingdoms, "the Heptarchy," as they are sometimes called, struggled among themselves for supremacy, which was accorded to the strongest king of the time, under the title of Bretwalda. The work of consolidation continued until the beginning of the 9th century, when the King of Wessex, Egbert, succeeded in establishing his own power. In the year 827 he became overlord of Mercia and Northumbria, and thus practically first king of all the English, from the English Channel to the Forth. No sooner, however, was the union of all the Teutonic inhabitants of the country complete, than the whole Christian organisation was threatened by the invasion of fresh heathen tribes of the same blood, but known as "Danes," from Denmark and Scandinavia. The next century is marked by a long struggle, broken in the reign of Alfred by the Treaty of Wedmore (878 A.D.), which allowed the Danes to remain under his overlordship N. of a line drawn between London and the Dee. The weak reign of Ethelred II. (980-1016 A.D.) gave them fresh opportunities of aggression, of which they were not slow to avail themselves. A war broke out, which ended, after the death of Ethelred, in the accession of the Dane, Canute. Ethelred's son, Edward, was brought up in Normandy, and there gained a love for Norman ways which was destined in after years materially to affect the development of England. Meanwhile, Canute exercised a wide sovereignty wisely. King already of England and Denmark, he conquered Norway, and was recognised as overlord by the king of the Scots. A northern empire was thus founded which in strong hands might have become a lasting power, but Canute's sons inherited none of their father's genius, and when they died, the empire was already broken up. Edward, who had come back from Normandy, was made king of England in the year 942.

A king of slight force of character, Edward surrounded himself with Norman favourites, but was compelled to leave most of the real power of government in the hands of Godwin, an English earl. Upon the death of the king, the Witan or Assembly of Wise Men, the national Parliament, chose Godwin's son Harold to reign; but William, Duke of Normandy, claiming the crown in virtue of a promise made by Edward, landed with an army, and defeated and killed Harold at the battle of Hastings (1066 A.D.). King by conquest, William determined to establish his power by law, and so compelled the Witan to elect him in the usual way. The old Teutonic customs were now too deeply rooted in the country to be easily displaced, and the Normans, French as they were in language and customs, belonged to the same Teutonic stock as the English. Thus they suffered the English institutions to remain as the basis of the new polity. The old rule of the kingship had been that—within the limits of the royal house, which in heathen times claimed descent from the god Woden—the succession should be by election of the nearest relation of the dead monarch who was fit to rule in peace and lead in war. Once, as we have seen, in the case of Harold, the Witan looked beyond the royal house for a

vigorous king; indeed, they actually set aside the claims of a prince who was still a boy. It may be noted in passing that the elective principle growing fainter in the course of subsequent history, but never entirely lost, was exercised by Parliament as lately as 1701, when the heir to the throne, being a Catholic, was excluded from the succession in favour of a Protestant kinsman. The Teutonic kingdom was formed by the union of several tribes, and was divided into shires, which still remain as divisions of the country. Each shire was ruled by an ealdorman, and had its own local government, an assembly with powers alike legislative, administrative, and judicial, at which all freemen had the right to attend. The shire was divided into hundreds or groups of several townships. Each township, composed of a number of families, had also its assembly. Society was divided into ranks; below the king came the earl, then the *thegn* or lesser nobleman, then the *ceorl* or freeman, and lastly the *thrall* or slave. In the development of this society, military service counted for much. The king and the nobles gathered bands of men around them whose fortunes depended on their own. Grants of land were the reward of aid in war, and so, at the time of the Norman Conquest, a system was already springing up akin to the more rigid Feudal System (q.v.) which prevailed afterwards. The aim of Feudalism was to produce an "army camped upon the soil." Lands were granted to tenants, and subdivided by them among under-tenants, on condition of military service, but every under-tenant in England was compelled to swear fealty to the king as well as to his own lord, in order to avoid the danger of a conspiracy among the tenants.

Besides the growth of this system of military land tenure, there were other lasting effects of the Norman Conquest. England was brought into closer connection with the Continent. The French possessions of the Norman dukes led to constant wars with France; the foreign influences and the centralisation of power in the hands of foreign rulers brought about a closer connection between the Churches of Rome and England. In the Contest concerning Investitures, when the Archbishop Anselm opposed Henry I. upon the homage claimed by the king from the holders of Church lands; in Becket's endeavour against Henry II. to keep spiritual courts for the trial of the clergy; in the imposition by the Pope of Stephen Langton as Archbishop upon King John; in the subsequent interdict upon the country, and attempt of the Pope to give away the crown of contumacious John to the French king, we see the steady and constant claim of Rome to spiritual dominion; while in the partial success of Henry I.; in the murder of Becket to please Henry II.; in the ineffectual struggles of John; in the statutes of Provisors and Præmunire, by which Edward III. denied the power of the Pope to dispose of benefices and to decide causes cognisable in the king's courts; and in the doctrines of Wyclif and the Lollards, we find the answer of English freedom already foreshadowing the great uprising of the Reformation. But beyond all other influences of the Conquest was the change wrought

DESCENT.	MONARCH.	DATE.	REIGNING PERIOD.					
			10 yrs.	20 yrs.	30 yrs.	40 yrs.	50 yrs.	60 yrs.
NORMAN LINE.	WILLIAM 1st	1066 to 1087	██████████	██████████				
	WILLIAM 2nd	1087 to 1100	██████████	██████████				
	HENRY 1st	1100 to 1135	██████████	██████████	██████████			
	STEPHEN	1135 to 1154	██████████	██████████	██████████			
PLANTAGENET LINE.	HENRY 2nd	1154 to 1189	██████████	██████████	██████████			
	RICHARD 1st	1189 to 1199	██████████	██████████				
	JOHN	1199 to 1216	██████████	██████████				
	HENRY 3rd	1216 to 1272	██████████	██████████	██████████	██████████		
	EDWARD 1st	1272 to 1307	██████████	██████████	██████████			
	EDWARD 2nd	1307 to 1327	██████████	██████████				
	EDWARD 3rd	1327 to 1377	██████████	██████████	██████████	██████████		
	RICHARD 2nd	1377 to 1399	██████████	██████████				
LANCASTER LINE.	HENRY 4th	1399 to 1413	██████████	██████████				
	HENRY 5th	1413 to 1422	██████████	██████████				
	HENRY 6th	1422 to 1461	██████████	██████████	██████████			
YORK LINE.	EDWARD 4th	1461 to 1483	██████████	██████████				
	EDWARD 5th	Ap. to June 1483	██████████					
	RICHARD 3rd	1483 to 1485	██████████					
TUDOR LINE.	HENRY 7th	1485 to 1509	██████████	██████████				
	HENRY 8th	1509 to 1547	██████████	██████████	██████████			
	EDWARD 6th	1547 to 1553	██████████	██████████				
	MARY	1553 to 1558	██████████	██████████				
	ELIZABETH	1558 to 1603	██████████	██████████	██████████			
LINE.	JAMES 1st	1603 to 1625	██████████	██████████				
	CHARLES 1st	1625 to 1649	██████████	██████████	██████████			
	COMMONWEALTH	1649 to 1660	██████████	██████████				
STUART	CHARLES 2nd	1660 to 1685	██████████	██████████	██████████			
	JAMES 2nd	1685 to 1688	██████████	██████████				
	WILLIAM & MARY	1689 to 1702	██████████	██████████				
	ANNE	1702 to 1714	██████████	██████████				
HANOVER LINE.	GEORGE 1st	1714 to 1727	██████████	██████████				
	GEORGE 2nd	1727 to 1760	██████████	██████████	██████████			
	GEORGE 3rd	1760 to 1820	██████████	██████████	██████████	██████████		
	GEORGE 4th	1820 to 1830	██████████	██████████				
	WILLIAM 4th	1830 to 1837	██████████	██████████				
	VICTORIA	1837 to 1901	██████████	██████████	██████████	██████████		
	EDWARD 7th	1901 to	██████████	██████████				

in the people by the infusion of practically foreign blood. Once settled in the country, the Normans rapidly mingled with their subjects. The effect upon the language was shown by the loss of inflexions and the entrance of foreign words. The new nation found its first literary expression in the reign of Edward III. in Langlande and Chaucer. [ENGLISH LITERATURE.] Among constitutional changes may be noted a great advance towards the modern trial by jury, which was made by the first Plantagenet King, Henry II. In England before the Conquest trials had been conducted by ordeal (q.v.) or by compurgation (q.v.), and the production of witnesses. The reforms of Henry were based upon an extension of testimony. He ordained that twelve men from each hundred and four from each township should present reputed criminals for trial by ordeal. Under Edward I. witnesses acquainted with the particular facts were added to this kind of grand jury. Only one further step was thus necessary—the separation of the witnesses from the judges—to establish the jury as we now know it.

A yet more important constitutional change in the first centuries after the Conquest was the introduction of the representative system into Parliament. Like all English reforms, it came slowly and almost imperceptibly about. In the Witan all freemen had perhaps (at least in theory) the right of attendance, which, however, was necessarily inoperative when long and costly journeys were required to reach the place of meeting. The first beginning of representation is seen when special orders were issued to secure the attendance of those whose presence was desired by the king; but a true and effective representation was begun by Simon de Montfort, who was compelled by the misrule of Henry III. to take the government into his own hands, and who summoned to the assembly two citizens from every important borough and two knights from every shire. From this time Parliament continued to develop. Members received "wages"—usually two shillings a day—during their attendance in and journeys to and from Parliament, a custom which did not entirely die out until the 18th century, and which certain politicians are now anxious to revive. The clergy were summoned regularly to send representatives, but their unwillingness to serve in a secular assembly led to their only holding separate meetings of their Convocation (q.v.). In the reign of Edward III. the one House of previous Parliaments was divided into the two Houses of Lords and Commons, which have continued ever since.

So the foundations of our political freedom were laid. Meanwhile the power of England was expanding. In the reign of Henry II. a partial conquest of Ireland took place. Edward I. subdued Wales and Scotland, but the complete incorporation of the latter country with England was hindered by his death, when it passed out of the feeble hands of his son into a new independence. The English relations with France were warlike. John lost the dominions in Normandy which had belonged to the English crown since the days of William the Conqueror; but Edward III., claiming the French throne through his mother, Isabella, a French

princess, began in 1337 a war, which, lasting until 1451, is known as the Hundred Years' War. Its course was marked by the victories of Crecy and Poitiers in the reign of Edward III.; by Agincourt in the reign of Henry V., and the recognition of that king as heir to the French throne on his marriage with Katharine, daughter of the reigning monarch; by the brilliant career of the peasant maiden, Joan of Arc, and the final expulsion of the English during the reign of Henry VI. Useless in its ultimate end, the war was disastrous in its effect upon English prosperity. Between the battles of Crecy and Poitiers, when the country was feeling the drain of men and money, a terrible plague, the Black Death, in the year 1349, swept away a large proportion—perhaps half—of the English population. With the scarcity of labour which followed, a rise of wages was the natural result, but this was sternly checked by the Statute of Labourers, which enacted that wages should continue to be paid at the rate usual before the plague. Discontent spread, and broke into revolt in the rising of the peasants under Richard II. The history immediately succeeding his reign is a record first of the French war already described, and then of the struggle between the Houses of York and Lancaster for the crown. A new period opened with the battle of Bosworth and the accession of the House of Tudor in 1485.

We now reach the transition from the mediæval to the modern world. The Renaissance (q.v.) and the discovery of America enlarged alike the mental and the physical worlds. Under Henry VIII. the Reformation (q.v.) set England free from the authority of the Pope, and paved the way for a toleration as yet almost inconceivable. A brief return to Catholicism under Mary was followed, under Elizabeth, by the complete establishment of the Church of England in its present form. In the reign of the latter came the noble outburst of literature in the writings of Shakespeare, Bacon, and Spenser [ENGLISH LITERATURE], and the great war with Spain, one partly of Protestants and Catholics, and partly for access to America, which already began to offer a home to English colonists. The peaceful succession of James VI., of Scotland, as the nearest heir by his descent from Henry VII. to the throne of England, secured the union of the two crowns. Good in this respect, the establishment of the Stuart dynasty was evil in another. Bigotry and extravagance in the character of James, combined to render a struggle between him and his Parliament inevitable. Puritanism (q.v.) was a rapidly rising creed, but James, devoted to the doctrine "No Bishop, no King," would make no concessions in the formularies and practices of the Church. His son, Charles I., pursued the same course, until, after trying every illegal way of raising money, and all means of maintaining religious uniformity, he found himself embroiled in war with his subjects. The Parliamentary forces at last succeeded, under Oliver Cromwell, in making him prisoner, after which his execution followed in 1649. Cromwell became Lord Protector of the Kingdom. During his rule the English were again called upon to engage

in war for the maintenance of their colonial position. The Dutch were now their rivals, and the war, ended for the time, broke out more fiercely in the reign of Charles II., who, after the death of Cromwell, was recalled to the throne. With his restoration Episcopalianism, lately suppressed, again became dominant.

The Test Act was now passed in 1673 to make the reception of the Communion in the Church the title to office, and in spite of enlarging toleration, it remained in force until 1828. The next king, James II., a Catholic, worked so injudiciously for his cause that his Protestant son-in-law, William of Orange, was invited to come over. Accordingly William and his wife ascended the throne in 1689—an event which is justly called “the Revolution,” for it altered the character of the kingship. The period of the Tudor and Stuart dynasties (1485–1688) may be described as one in which the object of the sovereign had been to secure personal rule. The Revolution, by substituting a parliamentary title in place of the Tudor and Stuart theory of divine right, secured the dependence of the crown on Parliament, and reasserted the forgotten right of election.

The death of William occurred on the eve of a useless war with France, which was marked, under his successor, Anne, younger daughter of James II., by the victories of Marlborough (q.v.). Her reign is also memorable for the literary activity of Swift, Pope, Addison, and Steele [ENGLISH LITERATURE], and for the union of the English and Scottish Parliaments in 1707—a step rendered necessary by commercial disputes, and by the danger that the Scots, on the death of the queen, would elect the Catholic son of James II. as king, instead of the more distant, but Protestant, heir of the House of Hanover, in whom the Act of Settlement of 1701 had vested the succession. That this fear was not unfounded, is shown by the outbreak on behalf of the Stuart Prince which occurred immediately after the accession of George I. The rebellion, promptly suppressed, left an interesting memorial in the form of the Septennial Act of 1716, by which, through fear of a majority in favour of the Stuarts, the duration of Parliament was raised from the then usual period of three years to seven. To-day there is some agitation for a return to the triennial system.

With the reigns of George II. and George III. we reach the greatest events of the 18th century—the Seven Years' War (1756–63),—the third and greatest war for a colonial position, by which England wrested the actual possession of Canada and the future possession of India from the French; and the American War (1775–83), raised on the question whether England had a right to tax the colonies, which were not represented in Parliament. Its results were as inglorious for England as those of the previous war had been glorious. After repeated disasters, the English were obliged to acknowledge the independence of the United States. At home the events of the French Revolution of 1789 were watched with keen interest and fear. The rise of Buonaparte compelled England to make war, and secured the triumphs of Nelson and Wellington (q.v.).

The 19th century opened in 1800 with the union of the English and Irish Parliaments—an event

which is still leading to great political excitement. The great towns which rose in the Midlands and North of England with the improvement of machinery and the introduction of steam, rendered an extension of the franchise necessary. By the Reform Bill of 1832 votes were given to the whole of the middle class, by that of 1867 to artisans in towns, and by that of 1884 to agricultural labourers. Elementary education has received pecuniary aid from Government, accompanied eventually by inspection and control, since 1833; and by the Education Acts of 1870 and 1876, School Boards were set up, and the attendance of children made compulsory. [EDUCATION.] By the Local Government Act of 1888 the establishment of representative County Councils made one more step in the democratic direction in which the political progress of this country has long tended. In 1899 the Boer War in South Africa broke out, and lasted until May, 1902. In 1901 Queen Victoria died, and was succeeded by her son, who was crowned as King Edward VII. in 1902.

Present Constitution. We have now traced the development of the English Government, and may note briefly a few of its characteristics. It is based rather on tradition and the evolution of accidental changes than on definite enactments. The sovereign, once practically despotic, “reigns, but does not govern.” The ministers are responsible for everything, and they are chosen, to-day, nominally by the monarch, virtually by the people through their representatives in the House of Commons. The power of the sovereign is purely personal, and is limited to the influence which his character and experience can bring to bear upon the ministers of the hour. The real government, both legislative and executive, is in the hands of the Cabinet, a body recognised by no statute. It consists generally of from twelve to sixteen members, who comprise the First Lord of the Treasury, the Lord Chancellor, the Chancellor of the Exchequer, and the principal Secretaries of State. Its head is the Prime Minister, who can be any of the above ministers except the Lord Chancellor. His relation to his colleagues is undefined, and depends on his own force of character and their pliability. The Cabinet remains in office only while supported by a majority in the House of Commons. Upon the first adverse vote on a question of importance, it resigns or advises the sovereign to dissolve Parliament in order to submit its policy to the electors.

In these proceedings the House of Lords has no part. Nominally the Upper House, its power is not so great as that of the Commons. It can check legislation, since no measure can become law without its consent; but this check is lessened by the fact that in practice the Peers cannot long resist the passing of a bill on which the country has shown itself bent at the general elections. In both Houses measures are considered clause by clause in committee, at which stage the Lords can largely modify a bill which they dare not reject. The number of Peers is liable to increase, as eminent commoners are often raised to a peerage. At present the house consists of about 600 members.

The right to sit is hereditary, except in the case of sixteen Scottish and twenty-eight Irish Peers, who are elected by their fellows, the former for a single Parliament, the latter for life; in that of four law lords, who hold life peerages; and in that of the two Archbishops and of twenty-four Bishops, whose seats secure for the clergy the representation in the Upper House, of which, as we have seen, they refused to avail themselves in the Lower. The House of Commons contains 670 members, the majority of whom constitute the support of the ministry. The remaining members, who may form one party or several parties, are called "the Opposition," and fulfil an important function in criticising the proposed measures of the Government, and thus securing that every clause shall be submitted to rigid scrutiny. Hitherto the two permanent parties in both Houses have been Conservatives and Liberals—the former devoted to the maintenance of the established institutions of the country, the latter taking as their watchwords progress and reform. At present, besides the Irish parties, there is, in addition, a strong Labour party, which aims at effecting legislative changes of a social character. It is, indeed, safe to say that, apart from the Imperial questions, which England's position, at the head of the greatest empire in the world, necessarily brings to the front, problems affecting the physical and social welfare of the masses are more and more taking the place once filled by purely political interests.

England. CHURCH OF. "The Church of England as by law established" is a corporation which at least in outward form and organisation dates back almost from the beginning of the nation. Its chief pastor is the Archbishop of Canterbury, as was the case also at the beginning of the seventh century; but, as will presently be seen, the identity of the present with the ancient body is a matter of serious controversy.

The Church of England was founded by Augustine, a monk sent from Rome by Pope Gregory the Great A.D. 596. He landed in Kent, and after a few years converted its king, and was consecrated Archbishop of Canterbury. The conversion of the country, however, was slow; it was divided into several kingdoms, and the internecine wars and jealousies were a great hindrance. Nevertheless, Christianity at length prevailed, and the country was marked out into episcopal sees. It was Archbishop Theodore (668-690) who unified the Church of England by bringing the bishops into one body under himself as primate. A few years later, under Egbert, its seventh bishop, York was made an archbishopric, with the northern bishops as suffragans of it. England was still divided into several kingdoms, but in 814 the union of kingdoms followed that of sees. The parochial system was organised as it remains to the present day.

How far these sees were under the authority of the Bishop of Rome is a matter on which theologians dispute, and we cannot discuss it here; but all agree that from the time of the Norman Conquest, when William I. pursued the policy of bringing England within the range of Continental

politics, the power of the Popes greatly increased in England. The Conqueror and his sons sought their assistance in difficulties, and the Popes in their turn put forward claims in a far more authoritative mode than before—claims which reached their height when King John was constrained to lay his crown at the feet of the Papal legate and to declare that he held his kingdom as a fief of the Holy See. From this time onward a reaction set in against the Papal claims, and legislation more than once was directed against them, especially during the reign of the first three Edwards.

The opponents of the Roman theory of the Church allege that there was a corresponding development of doctrine, and that opinions grew up concerning the ministry and the sacraments, which were not held in the days of Augustine. Whether or no, it is certain that in the fourteenth and fifteenth centuries strenuous attacks were made on the received theology, the central figure among the opponents being that of John Wyclif. The preachers of the "new doctrines" were known as Lollards, and fierce laws were made against them, subjecting them to death by fire.

In the sixteenth century came that great movement all over Europe known as the Reformation, the repudiation by a large portion of Christendom of the authority of the Bishop of Rome. The English Church followed the example of the Lutheran and Calvinistic religionists, but with noteworthy differences. The nation, as a body, declared that the Bishop of Rome had not by Divine right any authority over the Crown or Church of England, and proceeded to a measure of self-reform. This work began in the reign of Henry VIII., was carried on in the reign of Edward VI., came to a check under Mary, but was again taken up and completed under Elizabeth. The liturgy of the ancient Church was turned into English, but certain doctrines and devotions in it were expunged, on the ground that they were not warranted by the Scriptures nor by primitive custom. Hence the liturgy of the Church of England is in some respects like, in others unlike, that of the Roman Church. The Communion Service is to all intents and purposes modelled on the ancient liturgies; but the most remarkable feature of the English Reformation was the preservation of the old organisation. This stands unique in the history of the Reformed Churches. The bishops were consecrated by other bishops who had belonged to the ancient system, and the succession was unbroken. Matthew Parker's consecration as Archbishop of Canterbury under Elizabeth was on the ancient lines, and the Lambeth archiepiscopal registers stand on the shelves in an unbroken line—Wareham, Cranmer, Pole, Parker, and so on. The reformed liturgy took the place of the Latin service on Whit Sunday, 1549, and though there was a break under Mary, was resumed again under Elizabeth.

But in such a movement there were necessary difficulties and troubles. There were some who thought the reforms should have been more sweeping, and others who would fain have had them less so. To the former party must be traced the origin

of Nonconformity, the assertion of more independent thought and action than were found in the advocates of traditional beliefs. In the others we see the founders of the High Church school, which found its partisans in Hooker, Andrewes, and Laud.

These divisions of opinion continue still not only outside but within the Church. Some churchmen hold that the episcopate and the priesthood are essential features of any true branch of the Catholic Church; others that, though desirable, they are not necessary. The Roman Catholics hold that, since the authority of the See of St. Peter is set at naught, the preservation of the old organisation avails nothing.

The conflict between the Church and the Non-conformists came to a climax under Charles I., and the identification of the Church with the State policy of the king, in the popular mind, led to the temporary overthrow of the Church with that of the throne. After twenty years both were reinstated, and both have ever since continued. The failure of the Church, however, under the first Georges to preserve her independence and her spiritual life lost much ground to her. Under the preaching of Wesley took place a great revival, and, though its primary effects were outside the Church, the result has been a marked growth of life and energy. The Evangelical movement of the latter part of the eighteenth century was largely owing to his influence. To that movement succeeded that known as the "Tractarian," so called from the tracts put forth under the influence of John Henry Newman (1833-1841). Both of these movements are still bearing fruit, the one in the increased earnestness of preaching, the other in the growth of outward ritual and of Church restoration. The Church has of late years shown great energy in mission work, both at home and abroad; great sums of money have been spent on churches and schools, as well as in the development of the Colonial Episcopate.

English Language. [ALPHABET, GRAMMAR, LANGUAGE, PHILOLOGY.]

English Literature, the most remarkable as it is the most prolific of modern intellectual developments, is the product of many centuries. Mutation and transition necessarily marked its course before it attained to anything like its present perfection of form, and fullness and vigour of expression. Before the Saxons invaded Britain there was a Celtic literature of a rhythmic character, preserved, in the main, orally by the Gaelic and Cymric elements of the population. Gaelic literature is associated with Fionn, Ossian, and the battle of Gabhra, alleged to have been fought A.D. 284, while Cymric literature finds powerful utterance in Aneurin's poem, the *Gododin*, which celebrates the battle of Cattraeth, fought, according to tradition, in the year 603. During the 5th and 6th centuries various Teutonic tribes effected a settlement in Britain, and the island was ultimately subjugated by the Saxons. The institutions and language of the conquerors were largely imposed upon the natives, and so great has been the vitality of the Saxon speech that about two-thirds of the

words now composing the English language are, radically or derivatively, of Saxon origin. Gildas, the author of a Latin treatise on British history, is the precursor of the Anglo-Saxon writers, but the earliest author of real distinction is St. Columbanus, an Irish missionary to Western Europe, who wrote religious treatises and Latin poetry, and died in 615. Cædmon, a monk of Whitby, was, however, the first Anglo-Saxon writer of eminence who composed in his native tongue. Encouraged by the Abbess Hilda, he wrote his *Paraphrase*, in which he discoursed of the Creation and the Fall, and other Biblical themes. His verse was constructed neither in measure nor rhyme, but it was differentiated from prose by a kind of rough poetic alliteration. After Cædmon, who died about 680, came Aldhelm, Ceolfrid, and others, while there is also an anonymous work of importance, the romance of the Northern hero *Beowulf*. This poem may be described as the heathen complement to Cædmon's Christian *Paraphrase*. The Venerable Bede (673-735), who was born at Jarrow, and became the great monastic teacher of Wearmouth, wrote numerous works in Latin, the chief of which was his *Ecclesiastical History of the Anglo-Saxons*. Cynewulf (fl. 750) was author of some Anglo-Saxon poems in the Exeter Book and the Vercelli Book; while Alcuin (735-804), of York, was an earnest student and teacher, and became the chief intellectual light in the Court of Charlemagne. John Scotus Erigena (fl. 850) wrote, among other things, a work on the *Division of Nature*, which is regarded as laying the foundation of the scholastic philosophy. King Alfred (849-901), great in arms and noble and enlightened in character, translated into Anglo-Saxon the histories of Bede and Orosius, and Boethius's *Consolation of Philosophy*. Other contributions to literature are likewise attributed to him. Ælfric, the grammarian, who died c. 1006, wrote eighty *Homilies*. An anonymous poem on the battle of Maldon recites the victory of the Danes over Byrhtnoth. The well-known *Saxon Chronicle* is a survey of early English history, written by various authors. It began soon after the time of Alfred, and continued to the death of Stephen in 1154. Among its entries in verse is a spirited poem on the battle of Brunanburh, fought victoriously by Athelstan against his combined Danish and Celtic foes in 937. Besides the leading writers above cited, there were others of less importance who graced the Anglo-Saxon period of our literature—a period embracing some five hundred years from the time of Columbanus to the Conquest.

New conditions were imported into the learning and literature of England by the Norman Conquest. For nearly a century and a half the old language was supplanted by French and Latin. Monastic chronicles were the order of the day, and these were only of real value as they drew near to, and actually dealt with, contemporary events. Two of the most important of the monastic chroniclers were Ordericus Vitalis (1075-1143?), who wrote the *Ecclesiastical History of England and Normandy*, a conscientious if disorderly record, and William of Malmesbury, who flourished at the same time,

and wrote a *History of English Kings*. The latter writer has been placed by Milton next to Bede. Geoffrey of Monmouth, Bishop of St. Asaph, who died in 1154, wrote the *History of British Kings*. Much of this Latin chronicle is imaginative. It began with a mythical Brutus of Troy, and ended with Cadwallader. King Arthur was a prominent figure in the book, and from this time the romantic legends concerning him and his court became a prominent feature in the Anglo-Norman literature. Geoffrey of Monmouth's *Chronicle* was abridged by Alfred of Beverley, and rewritten in French verse by Geoffrey Gaimar and "Maistre" Wace, the latter version becoming permanent as the *Roman de Brut*. Wace, who died in 1184, was also the author of the *Roman de Rou*. Walter Map or Mapes (fl. 1200), poet and prose writer, gave form and substance to the Arthurian legends, uniting them into a harmonious whole as the spiritual allegory of the Holy Grail. Map attacked the abuses and corruptions of the Church in a series of witty and vigorous Latin poems. Hitherto there had been no man of such genius amongst our early writers. Early in the 13th century English began to recover its position, and Layamon's *Brut* was the first important piece of literature in transition English. Layamon, who was "a priest of Ernele-upon-Severne," wrote in English verse, and he interpolated many things into Wace's narrative. His work was completed about 1205. An Augustinian canon, named Ormin, was the author of *Ormulum*, a metrical paraphrase, with expositions, of the Gospel of the day. To the same period belong the early ballads of the Robin Hood type and the rendering into English verse of *Havelok the Dane* and other metrical romances. Roger Bacon, the great scientific investigator, was a Franciscan who settled at Oxford under Robert Grosseteste (afterwards Bishop of Lincoln). Bacon enshrined the results of his knowledge in his *Opus Majus*, *Opus Minus*, and *Opus Tertium*. Robert of Gloucester was a monk in the time of Henry III. and Edward I., who wrote in English rhyme a chronicle from the siege of Troy to the death of Henry III. William of Waddington, a Yorkshireman, wrote in French a *Manuel des Péchés*, which Robert de Brunne translated into English as *A Handling of Sins*. De Brunne also wrote a *Metrical Chronicle of England*. A collection of proverbial sayings, embodying the wisdom of the people, was gathered together at the close of the 13th century under the title of *Proverbs of Hendyng*.

The first great era of English literature may be said to begin about the year 1300, and to extend to the introduction of printing by Caxton in 1477. The overshadowing name in this period is that of Chaucer, who has been styled the Father of English Poetry. The accounts of his early life are uncertain, but he acquired the favour of Edward III. through John of Gaunt. In the reign of Richard II., however, he fell upon evil times, and he died in the year 1400, aged about 60. Chaucer's *Canterbury Tales* are immortal, alike for their poetic qualities, their unrivalled delineations of character, and their pictures of the middle-class English life of the period. Although the poet was influenced in his

style and choice of subject by Dante and Boccaccio, he infused into his creations a dramatic force and a breadth of sympathy which are the characteristics of the highest genius. His other works include *The Legend of Good Women*, *Troilus and Cressida*, *The Book of the Duchess*, *The Assembly of Foules*, *The House of Fame*, and some minor pieces. Hallam classed Chaucer with Dante and Petrarch in the mighty poetic triumvirate of the Middle Ages. John Gower (1325?-1408), next in contemporary importance to Chaucer, wrote the *Confessio Amantis*, an English poem, which included a number of tales that were moralised to illustrate the seven deadly sins. *The Vision of Piers Plowman* was by William Langland, a monk of Malvern (fl. 1380), and four or five other writers. It "sought to animate men to the search for Christ, and battled vigorously with Church corruptions." It is distinctly English in its language, and shows clearly the workings of the national mind in religion and politics. James I. of Scotland takes high rank for *The King's Quhair*, and Laurence Minot for his series of war-songs on the victories of Edward III. Barbour's heroic poem of the *Bruce* also calls for mention. Thomas Occleve, author of a poem on the duty of kings, and John Lydgate, to whom we owe the *Falls of Princes*, and other compositions, were likewise considerable poets. For a long period Sir John de Mandeville was regarded as "the father of English prose," but this claim is now abandoned, as it has been shown that Sir John was an entirely fictitious person, and that his *Travels* were compiled from Pliny, the Golden Legend, Friar Ordoric of Pordenone, and most of the mediæval travel books, geographies, and histories, probably by Jean d'Oultremouse, a reclusive and voluminous writer, of Bruges. John Wyclif (1324-1384), who gave to his countrymen the first English version of the whole Bible, has been not inaptly styled the "Morning Star of the English Reformation." Among the legal writers of the period are Sir John Fortescue (1394?-1476?), author of *De Laudibus Legum Angliæ*, and other works, and Sir Thomas Littleton (1402-1481), author of the famous treatises on Tenures.

William Caxton, who introduced the art of printing into England, gave an impetus to literature whose effects have been of incalculable value. The earliest work which can with certainty be maintained to have been printed in England was the *Dictes and Sayings of the Philosophers*, published in 1477. In 1474, however, Caxton had issued at Bruges the first book printed in the English tongue, the *Recuyell of the Histories of Troye*, and soon after this he printed the *Game and Playe of the Chess*. Caxton was a most assiduous worker, and produced editions of Chaucer, Lydgate, Gower, and Sir Thomas Malory's *King Arthur*, translations of Cicero's *De Senectute* and *De Amicitia*, and other works. A cluster of fine poets adorned Scottish literature at this period, including Robert Henryson, schoolmaster, of Dunfermline, who wrote the first English pastoral, *Robin and Makyn*, and a sequel to Chaucer's *Troilus and Cressida*; Gavin Douglas, Bishop of Dunkeld, who completed the first English translation of the

Aneid: Sir David Lyndsay of the Mount; and William Dunbar. Lyndsay's *Play or Satire of the Three Estates* "was the most important example in our literature of the Morality Play that expressed moral teaching by the dramatic action of personified attributes and forms of life. It shadowed forth the reform wanted in the Church of Scotland, and the passing of the Estates in 1540 of what was called a friendly act of reformation was prepared for by the public acting of this satire in the presence of the king." In his poem on the *Monarchie* Lyndsay became distinctly Lutheran. William Dunbar, the Chaucer of the North, was placed by Sir Walter Scott at the head of the roll of Scottish poets. Dunbar led a chequered life, and his works are remarkable for their strong human lights and shadows. His allegorical poem, *The Thistle and the Rose*, was written in celebration of the marriage of James IV. with Henry VII.'s daughter Margaret. *The Golden Terge*, another of his poems of fantasy, is very descriptive and rhetorical. *The Dance of the Seven Deadly Sins* powerfully depicts—under the lead of Pride—a procession of the seven deadly sins in the infernal regions. Dunbar was equally remarkable in the comic as in the serious vein. He died about 1530. England had no contemporary poets equal to these. Alexander Barclay translated Brandt's satire, *The Ship of Fools*; Stephen Hawes produced *The Pastime of Pleasure*, an allegory upon the course of life; and John Skelton his *Colin Clout*. Skelton was the strongest, as well as the coarsest of the three, and his vigorous lampoons on the clergy drew down upon him the anger of Wolsey.

At the close of the 15th century many of the best spirits of the age were drawn to Oxford for the study of Greek. It was taught by William Grocyne and the physician, Linacre. Erasmus came over from Paris to acquire it, and while at Oxford he made the acquaintance of young Thomas More, who wrote a defence of the new branch of learning. More afterwards entered upon the thorny paths of statecraft, and paid for his opposition to Henry VIII. with his head. More was the leading prose writer of his time, and his *History of Richard III.*—in which he draws a sombre picture of the usurper—has been called the earliest specimen of classical English prose; but his real fame rests upon the *Utopia*, in which he imagines an ideal commonwealth in the New World, discovered by a supposed companion of Amerigo Vespucci. The root idea was borrowed from Plato. More was jealous of a too popular treatment of the Scriptures, and published various treatises against the Lutheran doctrines. When William Tyndale completed his famous translation of the New Testament in 1525, More adversely criticised it on the ground of its Lutheran bias in the choice of words. Tyndale replied with spirit, however, and also defended against More the exposition of the Lord's Supper published by John Frith. In 1530 Tyndale completed, with the help of Miles Coverdale, his translation of the Pentateuch, and six years later he was put to death for heresy in Belgium. Coverdale's translation of the whole Bible appeared in 1535. Many Church writers and reformers flourished

at this time. To Cranmer was largely due *The Book of Common Prayer*, a work which contains some of the noblest specimens of English in our literature. He was also responsible for a book of *Twelve Homilies* and a revised translation of the Scriptures, known as *Cranmer's Bible*. The martyr Latimer was the author of sermons which are rare specimens of vigorous eloquence, while Bishop Fisher preached and wrote trenchantly on the other side. John Leland, who died insane in 1552, was the father of our archaeological literature. John Knox, the great Scottish reformer (1505–1572), wrote a *History of the Scottish Reformation*, and he was so indignant at the fact that three ruling sovereigns were women that just before the accession of Elizabeth he issued from Geneva his *First Blast of the Trumpet against the Monstrous Regiment of Women*. John Foxe, the martyrologist (1516–1587), did much for Protestantism by his work on the *Acts and Monuments of the Church*; and Roger Ascham (1515–1568), classical tutor to Queen Elizabeth, and author of *Toxophilus* and *The Schoolmaster*, was the first writer on education in the language. Mention must not be omitted here of the unfortunate Earl of Surrey (1517–1547), who was the first writer of blank verse in England, and who did much to invest our poetry with accuracy, polish, and a general spirit of refinement. Surrey used the medium of blank verse in translating two books of the *Aneid*. With his friend, Sir Thomas Wyatt (1503–1542), he also transplanted the sonnet into the garden of English verse.

The most brilliant, as well as the most virile, era in English literature was that extending from the accession of Elizabeth in 1558 to the closing of the theatres by the Long Parliament in 1648. No other period of ninety years in our history exhibits such a profusion of literary effort and achievement, especially on the dramatic and imaginative sides. The former portion of this period, however, known as the Elizabethan age—but really extending to the middle of the reign of James I.—was the greater in conception. It witnessed not only the rise but the culminating splendour of the drama. Miracle plays or mysteries were the forerunners of the drama. They were acted in churches and convents, and by their dramatic representations of Biblical episodes it was sought to influence the people in favour of virtue. There was something grotesque, however, in the choice of Satan as the first comedian, while the general treatment of sacred subjects was most objectionable. In course of time the plays changed into moralities, in which abstract qualities such as Justice and Vice took the place of Scripture characters. Next to these, and before the drama proper, came a series of farcical productions, of which Heywood's *Interludes* may be taken as a type. One great name interposes between these early plays and the drama, namely, that of Edmund Spenser (1552–1599). He restored the glory of English poetry from the long eclipse it suffered after the death of Chaucer. Spenser's *Shepherd's Calendar* applied pastoral images to the religious conflicts of the time, and under the name of Algrind he introduced Archbishop Grindal, whose firmness in encouraging free search for Scripture

truth he applauded. To his master, Chaucer, the poet paid tribute under the name of Tityrus. In 1590 he published the first part of his great but unfinished epic *The Faërie Queene*, in which he depicted man with all his capacity for good striving heavenwards. The work is "an intense utterance of the spiritual life of England under Elizabeth." Spenser's *Colin Clout's Come Home Again* was written in memory of his friendship for Sir Walter Raleigh. The purely poetic qualities were abundant in Spenser, and these have made him a favourite with all his singing brethren since his death. Sir Philip Sidney (1554-1586) has gained a reputation as an English classic for his *Defense of Poesie*, but his romance of *Arcadia*, though perhaps not so well known, was the more warmly appreciated on its publication. Influenced by the Spanish romances, it is rich and highly finished in its phrases, and "full of fine enthusiasm and courtesy, of high sentiment, and of the breath of a gentle and heroic spirit."

The first English comedy, *Ralph Roister Doister*, was written by Nicholas Udall, Master of Eton, between 1534 and 1541. It was avowedly modelled upon Plautus, and intended for the edification of Eton boys. The first tragedy was *Gorboduc*, a new rendering of the old British story of Ferrex and Porrex by Thomas Sackville (Lord Buckhurst), and Thomas Norton. It was acted at the Inner Temple on the 18th of January, 1561, and also before the queen by command. It substituted English for Latin in a play constructed after the manner of Seneca, and "its grave dwelling upon the need of union to keep a people strong, a truth of deep significance to England at that time, pleased Elizabeth." But nearly twenty years yet elapsed before the drama obtained a stable hold, and theatres began to be built. John Lyly, author of the *Euphues*, wrote a number of mythological plays, and George Peele produced *The Arraignment of Paris* and *The Deceit of the Pageant* in 1584-85; but Christopher Marlowe, with his "mighty line," was the first great Elizabethan dramatist. His genius was sombre, and his tragedies dark and terrible. His *Tamburlaine the Great* was produced in 1587, but his *Doctor Faustus* was not published until ten years after his death, which occurred in 1593. Robert Greene, Thomas Lodge, and Thomas Kyd wrote during the last two decades of the 16th century; and at this time began the career of the greatest poet the world has ever seen, William Shakespeare (1564-1616). A period of less than 25 years covers the production of all those comedies and histories which are the wonder of modern literature. We marvel what kind of man that could be whose intellect could conceive such widely different works as *A Midsummer Night's Dream*, *Venus and Adonis*, *Romeo and Juliet*, *The Rape of Lucrece*, the famous *Sonnets*, *The Merchant of Venice*, *Othello*, *Macbeth*, *King Lear*, and *Hamlet*. Shakespeare seems to sum up within himself the whole of poetry and of human philosophy. His power and universality are unique, and will probably ever remain so. Ben Jonson, the greatest and most scholarly of his contemporaries, wrote from 1596 to 1637; but he lacked the freedom and naturalness of Shakespeare.

Beaumont and Fletcher worked in unison with a success rarely attained by collaborators. Massinger was a dramatist of undoubted power, as his *New Way to pay Old Debts* testifies; and Dekker, Heywood, Marston, and Middleton would all have taken a higher niche in the temple of fame had they lived in a less prolific age. Ford and Webster produced plays of a dark and terrible cast, and the list of Elizabethan dramatists closes with James Shirley, who was purer in thought and expression than any of his predecessors. With regard to other poets of this period, Thomas Tusser gave an excellent picture of English peasant life in his *Five Hundred Points of Good Husbandry*, and Michael Drayton described this favoured isle itself in his *Polyolbion*. The learned John Donne gave utterance to his metaphysical conceits, while Drummond of Hawthornden attested his claim to the title of the finest Scottish poet of his day. Towards the close of the period Carow, Herick, and Suckling produced their exquisite lyrics, and Herbert chanted the solemn strains of *The Temple*.

The great prose writers of the period must be headed with the illustrious name of Francis Bacon (1561-1626). The father of the inductive philosophy was regarded by those of his contemporaries who knew him best as "one of the greatest men and most worthy of admiration that had been for ages." His adventurous intellect could not be bound by mere tradition. He brought his keen analytical faculty to bear upon the study of man and nature, so that in his matchless *Essays* we have the result of his penetration into the human mysteries, while his philosophy of nature stands revealed in the two books of the *Advancement of Learning*, in which he laid the basis for his *New Organon*. "Who is there," Burke demands, "that upon hearing the name of Lord Bacon does not instantly recognise everything of genius the most profound, everything of literature the most extensive, everything of discovery the most penetrating, everything of observation of human life the most distinguishing and refined?" George Buchanan (1506-1582) ranks as the Scottish Virgil from the elegance of his Latin verse, while he exhibited equal command over Latin prose. Richard Hooker (1564?-1600) gave a new elevation and dignity to English prose by his *Laws of Ecclesiastical Polity*. Sir Walter Raleigh, the admirable Crichton of his age, carried the English name abroad, but returned only to find imprisonment and the scaffold (1618). He glorified his prison life by the production of his great *History of the World*, which is especially memorable for its vivid recital of the histories of Greece and Rome. Camden the antiquary constructed his *Britannia*, and Hakluyt and Purchas compiled their wonderful records of travel. James I. threw his ill-digested learning into treatises on Divine Right, Witchcraft, etc.; Burton wrote his quaint and erudite work, *The Anatomy of Melancholy*; Selden, the chief of the learned men of his time, according to Milton, alternated pontics with the production of his *Treatise on Titles of Honour* and his *History of Tithes*; Hobbes of Malmesbury, the terseness of whose style is unique, promulgated his theory of action and morals, as well as his

absolutism in politics, in the *Leviathan*; Howell first showed what correspondence might become in his *Familiar Letters*, and genial old Izaak Walton wove an immortal spell over all lovers of good literature by his *Lives of Donne, Hooker*, and others, and *The Complete Angler*. Altogether the age was one eminently full of intellectual life.

The decline of the drama, and the end of what we may call the Pagan Renaissance, were contemporaneous with the birth of the great constitutional struggle which began with James I. and did not terminate until the Revolution. It is strange that such a time of upheaval should have produced the greatest Christian epic, *The Paradise Lost*, and the greatest Christian allegory, *The Pilgrim's Progress*, which are to be found in any literature. Three great men represented the various forms of the religious struggle going forward; the saintly Jeremy Taylor (1613-1667), a poet amongst preachers, upheld the cause of Episcopacy; Richard Baxter (1615-1691), while desiring the church discipline and the form of belief, advocated a greater liberty for the individual conscience; and John Milton (1608-1674) was a type of the religious freedom and toleration which found best exposition in the principles of the Independents. Milton's *Eikonoklastes* broke down the buttresses of kingly authority; his *Areopagitica* was a noble argument in behalf of intellectual liberty; while his *Paradise Lost, Paradise Regained*, and *Samson Agonistes* were not merely magnificently great as poetry, but Christian evidences of the most sublime type. John Bunyan (1628-1688), a man of the people, came forward with words that burn and images that enthrall, to show the way from a world of vice to a pure and Holy City. Thomas Fuller, remembering that "blessed are the peacemakers," sought to heal that strife between king and people which was beyond all healing save that of the sword. Some men held themselves aloof from violent controversy while yet maintaining independence of thought—as, for example, Sir Thos. Browne in the *Religio Medici*, published in 1642. The anti-Puritans had their champions in Samuel Butler, whose fierce wit blazed forth in *Hudibras*; in the great Royalist writer, Clarendon; and in that staunch Royalist and Churchman, Bishop South, whose antipathy to the Nonconformists may be partly consoled by his brilliant wit. Among other writers of the time may be mentioned the versatile Barrow; the powerful satirists Wither and Bishop Hall; Harrington, the author of the *Oceana*; the patriotic Algernon Sidney, with his admirable *Discourses on Government*; and those garrulous but inimitable chroniclers Pepys and Evelyn. The poets were many and varied, including Waller, Davenant, Denham, Marvell, Lovelace, and Cowley. Extremes always lead to revulsion, and from Puritanism we pass to the licentious Court of Charles II., with the songs of Rochester, and the works of Etherege. The comic dramatists of the Restoration and the period immediately succeeding—Wycherley, Congreve, Vanbrugh, and Farquhar—vividly and wittily reflect the glittering life and base morality of the age. One stronger intellect did bring with it for a time the sense of a fresher and diviner air.

when John Dryden sang with vigour and insight, and also produced his best comedies and tragedies. Otway likewise showed a momentary gleam of the old Elizabethan dramatic fire. In the sphere of mental and natural philosophy, Locke, Newton, and Boyle grappled with problems hitherto considered insoluble, and illumined for the world the devious and mysterious paths of scientific inquiry. The selection of names in every branch of English literature, and in every age, can, of course, only be illustrative, not exhaustive.

The 18th century witnessed a great revolution in our literature, especially on the poetic side. Imagination, passion, and nature, were dethroned, and poetry became didactic, philosophical, and political. Dryden manifested something of the qualities of both schools, but when Alexander Pope arose (1688-1744) the new order triumphed. Everything was sacrificed to precision and artificiality. Pope was the most brilliant and impressive of the new writers. His *Essay on Man* and his *Essay on Criticism* enshrined many old philosophical truths in epigrammatic form. The heroic couplet became in his hands an instrument for cutting diamonds, but the lover of poetry longs after a time to exchange his dazzling couplets for the flowers of poetry. In all that he did, however, whether the work took the form of satires, essays, epistles, or translations, Pope was the finished artist. The minor poets of Pope's period included John Philips, known by his *Splendid Shilling*; John Gay, the author of the *Shepherd's Week*, and the *Fables*; Samuel Garth, the writer of the mock heroic poem of *The Dispensary*; and Richard Blackmore, who tried to restore the epic in *Prince Arthur*. Prose literature had many distinguished exponents. Jonathan Swift (1667-1745) looms up before us as a gloomy, overshadowing figure, whose saturnine genius found bitter yet powerful expression in *Gulliver's Travels*, the *Battle of the Books*, and the *Tale of a Tub*. His command of English was masterly, but his wit was coarse, his life hopelessly sad, and his death miserable. Daniel Defoe (1661-1731) was not only one of the most vigorous of political pamphleteers, but practically the father of the English novel by his *Robinson Crusoe*, a work which has surpassed almost every other in its uninterrupted popularity. Defoe invested fictitious events with an unapproachable semblance of truth. Metaphysical literature had its best representative in the philosopher, Bishop Berkeley, the founder of Idealism in English philosophy; Bernard de Mandeville unfolded a new satirical philosophy in *The Fable of the Bees*, which was intended to prove that the vices of society are the foundation of civilisation; and Bishop Butler sought to reconcile reason and revelation by his closely argumentative work, the *Analogy of Religion*. A new and interesting form of literary effort, which popularised letters and criticism, was the periodical essay, instituted by Joseph Addison (1672-1719) and Sir Richard Steele (1672-1729). The latter began the *Tatler*, which dealt in humorous and incisive fashion with the social and political life of the times. Steele was aided by Addison, and they afterwards founded the more famous *Spectator*, which was inimitable in its

humour and criticism. The *Guardian* and the *Freeholder* followed, and a higher tone was given to both literature and manners by these admirable publications. The modern newspaper had its origin in the *Public Intelligencer*, begun in August, 1663, by Sir Roger L'Estrange. The *Oxford Gazette* began in November, 1665, and the *London Gazette* on the 5th of February, 1666. Defoe, while in prison, began the publication of the *Review* (February, 1704). The drama at the close of the 17th century had, besides the greater names already mentioned, Sedley, Shadwell, Mrs. Behn, and Mrs. Centlivre, all of whose comedies, however, were licentious. Nicholas Rowe wrote heavy tragedies, which are no more likely to rise again in popularity than Addison's *Cato*. Foote, Cibber, and Fielding reproduced the follies of the times in their comedies and farces; and the *Beggar's Opera*, by Gay, produced in 1728, was the first specimen of the English ballad opera. Sentimental comedy is associated with Macklin, the Colmans, Murphy, Cumberland, and others; but the two greatest names in English comedy in the 18th century are Goldsmith and Sheridan. The delightful humour of *The Good-natured Man* and *She Stoops to Conquer* is only to be matched by the sparkling wit of the *Rivals* and the *School for Scandal*.

It has been the fashion with some critics to sneer at the 18th century, but the period from 1740 to 1800 was a very living one in English literature. Sturdy Samuel Johnson, born in 1709, began to write in 1743, and from that period until his death in 1784 he was an acknowledged leading power in letters. His *Lives of the Poets*, his *Rasselas*, *The Rambler*, and the great *Dictionary* were remarkable undertakings in various fields; while the world could afford to part with a thousand masterpieces rather than lose that immortal *Biography* by Boswell, which has enshrined his master's opinions and conversations. The *Letters of Junius* remind us of the right of criticism over public events and public men, and of the struggle by which the freedom of the press was ultimately won. The modern novel of actual life and manners dates from 1740, when Samuel Richardson published his *Pamela*, a story that was the talk and wonder of the town. It was followed by *Clarissa Harlowe*, its author's masterpiece—a book charged with pathos, and instinct with tenderness and morality. Henry Fielding, "the prose Homer of human nature," and, if not so delicate, a more powerful artist than Richardson, issued his *Joseph Andrews* in 1742, and his world-famous *Tom Jones* in 1749. Tobias Smollett wrote his *Roderick Random* in 1748, and this was followed by other stories as realistic as Fielding's, but much more marred by caricature. Laurence Sterne's *Tristram Shandy* and the *Sentimental Journey* were novelties in prose writing, and, although they are thin as novels, they will live for their peculiar wit and pathos. Goldsmith's *Vicar of Wakefield*, published in 1766, stands alone for its idyllic beauty and charming simplicity. Fanny Burney's *Evelina* and *Cecilia* (1778, 1782) were noticeable for invention and observation and skill in portraiture.

The poetry of the second half of the century was

varied in character, but it closed with the great Romantic Revival. To the heavy religious poems of Blair and Young succeeded the more artistic strains of Gray and Collins and Goldsmith, and the mystical yearnings and Elizabethan fervour of Blake. Thomson, one of the most excellent of our descriptive poets, had given place to Shenstone, who had less genius but more taste, and a third writer of the Spenserian stanza was found in Beattie. Percy's *Reliques of Ancient English Poetry* brought the ballad again into favour; while Chatterton deceived the very elect by his marvellous imitation of the older forms of poetry. William Cowper (1731-1800), notwithstanding his fastidiousness and over-refinement, was a poet of a high and genuine order. He let nature have its way in such exquisite poems as the *Lines to his Mother's Picture* and the *Loss of the "Royal George,"* while any humourist might envy the delightful abandonment of *John Gilpin*. His larger poems are severer in style, yet many of their pictures, testifying to a reverent love of nature, remain imprinted on the memory; and they are full of happy phrases and turns of expression. The new life infused into Scottish poetry was heralded by Michael Bruce, a sweet singer who died at twenty-one, and by Allan Ramsay, whose pastoral drama of the *Gentle Shepherd* (1725) affords one of the most beautiful and tender pictures of Scottish rural life. The ballad acquired a new pathos and interest in such productions as Lady Anne Burnard's *Auld Robin Gray*. But the poetic genius of Scotland found its ripest and fullest expression in Robert Burns (1759-1796). His love songs have the freshness and fervour of the Elizabethan lyrics; his poems of man and of nature, like those of Cowper, reveal the highest aspirations for the welfare of humanity; his humorous compositions are as lifelike in their character-painting as they are full to overflowing of fun; and his serious poems reveal a pathos which has never been excelled. Nature seemed to put on new beauties when Robert Burns chanted her praises, and the daisy can never again seem commonplace since he immortalised it. The poet at length acquired their laureate in this poet of the north.

Historical and philosophical literature attained a high level at this period. Edward Gibbon, though lacking human sympathy, had great creative power and originality, and his *Decline and Fall of the Roman Empire* is one of the most massive of historical conceptions, worked out with stately eloquence. David Hume, whose *History of England* does not take such high rank, was more original in his philosophical speculations, referring all actual knowledge to experience, and making utility the standard of virtue. Adam Smith, by his *Wealth of Nations* (1776), founded the modern system of political economy. All questions of labour, etc., were placed by this work on a scientific basis, and it paved the way for the doctrine of Free Trade. Edmund Burke's *Reflections on the French Revolution* (1790) caused a revulsion of feeling against France, while his *Letters on a Regicide Peace* increased the war fever in England. The former work was answered by Thomas Paine in his *Rights*

of *Man*, and the latter by Sir James Mackintosh in his *Vindiciæ Gallicæ*. Burke's philosophical works are models of eloquence and construction. William Paley, in his *Evidences of Christianity* (1794) and other works, skilfully defended revealed religion against the attacks of its enemies. Towards the close of the century *The Times* and other important journals were established; knowledge was condensed and methodised in *Cyclopædias*; while criticism took a wider range in the first decade of the 19th century by the foundation of the *Edinburgh* and *Quarterly Reviews*.

Among the hymnologists of the 18th century whose compositions are yet in use may be mentioned Toplady, John Newton, the Wesleys, Isaac Watts, Cowper, and Philip Doddridge.

The literature of the 19th century is almost overwhelming in its magnitude and variety. Although the century opened when Crabbe, the reporter of rural life, was painting his Dutch-like pictures, we pass on to a great revival in imaginative poetry before 1820. Byron, with his precociousness in love and genius, took a high flight in his *Child Harold*, and although all his works were impressed by his own gloomy personality, he yet made living verse. Shelley, imbued with revolutionary ideas and high aspirations, was one of the greatest poets of all time, now elegiac in his *Adonais*, and now passionate in his lyrics. No singer was ever more deeply inspired. Wordsworth, contemplative and philosophic, the patriarch of the Lake School, taught the dependence of the poet on nature, and from the *Lyrical Ballads* to the *Excursion* he illustrated his saying, that "poetry is emotion recollected in tranquillity." He threw off the conventional, and endeavoured to pierce to the heart of things, whether in man or in nature. Fancy and imagination were made perfect in the sensuous verse of Keats; wit and pathos in Thomas Hood; while narrative and romantic poetry found exemplars in Southey, Scott, Rogers, Campbell, and Coleridge. Cunningham wrote his Scottish songs, and Keble the *Christian Year*. The historical novel was made memorable by Sir Walter Scott, whose extraordinary fecundity was the wonder of his generation. His novels were the first and greatest prose result of the revived spirit of romanticism. Jane Austen's pictures in *Pride and Prejudice* and *Mansfield Park* are unequalled.

The Victorian age may justly be called great in all branches of literature. Macaulay, in the earlier half, illumined history by the brilliant flow of his imagination; while in the latter, Carlyle was not only his equal in history and his superior in philosophy, but the first man of letters of his time. In all his works—*Sartor Resartus*, his prose epic, *The French Revolution*, his *Cromwell*—he upheld the dignity of labour and the sacredness of duty. History found many brilliant interpreters, among whom are Hallam, Freeman, Froude, Buckle, Miss Strickland, Kinglake, Stubbs, J. H. Green, J. S. Brewer, Lecky, S. R. Gardiner, and Jas. Gairdner; Merivale wrote on Rome, Grote and Thirlwall on Greece, and Milman on the Jews. Among the more recent historians are Bishop Creighton, J. A. Symonds, G. Macaulay Trevelyan, Professor Bury,

the Abbot Gasquet, Hodgkin, Sir Clements Markham, Martin Hume, Oman, Oscar Browning, Peter Hume Brown, Mrs. Creighton, and Mrs. J. R. Green.

In philosophy and logic mention must be made of Sir William Hamilton, J. S. Mill, Brewster, Whately, Bain, F. D. Maurice, Ferrier, Herbert Spencer, Professor Caird, Jevons, Dr. Mivart, the Duke of Argyll, T. H. Green, Bosanquet, Dr. Martineau, Ruskin, Walter Pater, and A. J. Balfour; while science was revolutionised by the labours of Charles Darwin, A. R. Wallace, Tyndall, Huxley, and many later writers. Religious thought was deeply impressed by Newman, Pusey, Liddon, Matthew Arnold, Maurice, Stanley, Martineau, Gladstone, Spurgeon, Sayce, Cheyne, Driver, and others; and biography and criticism found representative writers in Lockhart, "Christopher North," De Quincey, Forster, G. H. Lewes, Masson, Sir Theodore Martin, and Trevelyan. The biographers were followed in the younger generation by Leslie Stephen, Sidney Lee, Lord Rosebery, and Viscount Morley; while the critics and essayists include Dr. Richard Garnett, William Sharp, Saintsbury, Furnivall, Conrthope, Churton Collins, Edmund Gosse, Birrell, Gollancz, Stopford Brooke, Walter Raleigh, Edw. Dowden, Arthur Symonds, and Andrew Lang.

The literature of fiction has been so enormous in extent and variety that it is impossible to do more than mention its chief ornaments. Thackeray showed to what a height, literary excellence, and finish the novel might attain, and with Dickens—the Hogarth of modern novelists—demonstrated its power as a moral scourge; "George Eliot" and Charlotte Brontë reflected much of the sadness and unrest of their time in their careful—almost meticulous—works, besides proving that women can occasionally reach the heights of literary excellence; and Mrs. Gaskell showed herself an artist in the portrayal of certain aspects of life. Among later women writers Mrs. Oliphant, M. E. Braddon, Mrs. Henry Wood, C. M. Yonge, "Ouida," Mrs. Humphry Ward, and Lady Ritchie are noteworthy.

Anthony Trollope, Benjamin Disraeli, Lord Lytton, Wilkie Collins, Charles Reade, and Charles Kingsley produced many powerful novels; while the works of Marryat, Ainsworth, G. P. R. James, Warren, and Charles Lever—though not in the first rank—are not forgotten. Of more recent novelists those that chiefly stand out are R. L. Stevenson, George Meredith, and Thomas Hardy. Stevenson was a master of style; Meredith's excellence lay in his brilliant wit, his elaborate portraiture, his strength, directness, and his powers of dramatic presentment. In artistic expression and as an intellectual force he has had few equals. Other novelists that call for notice are Shorthouse, W. Clark Russell, George MacDonald, R. D. Blackmore, "Henry Seton Merriman," "Anthony Hope," Stanley Weyman, Rider Haggard, J. M. Barrie, H. G. Wells (also memorable on account of his social-philosophical works), Conan Doyle, Eden Phillpotts, Joseph Conrad, and Rudyard Kipling—the last of whom has attained almost equal fame in the field of ballad and song.

Three names stand out from the galaxy of poets who adorned the Victorian era—Tennyson, Brown-

ing, and Swinburne. Tennyson's breadth of range, his wonderful mastery of musical phrase, his facility in stringing—as he himself expressed it in a different connection—"jewels five-words-long," no less than his instinctive poetic feeling, gave him a place in his lifetime that had, perhaps, never been attained by any poet, and from which it would be difficult to dethrone him. His *In Memoriam* summed up the religious aspirations and a great deal of the philosophy of the time; his *Idylls of the King*—widely popular for many years—were more successful as poetry than as an attempt to give modern readers a rendering of the heroic deeds of Arthur and his Knights of the Round Table; but his lyrics were the finest since Shelley's, and it is probably by these and his shorter poems that he will live. His few dramas had little success as dramas, but *Becket* is still revived from time to time. Browning, always massive and profound in thought, and of all moderns the most full of energy and moral aspiration, was, at his best, peerless in his own line, and when one has deducted the prose cut up into lines to make it look like poetry (most of which belongs to his later years) the residuum contains some of the finest poetry that was ever penned. Of his longer poems *The Ring and the Book*, *Paracelsus*, and *Sordello* are the most typical, but many of his short pieces and songs are perfect, and are better known. Swinburne was—perhaps even in a higher degree than Tennyson—a master of music and rhythm, and he couched the newest and most astonishingly beautiful, bizarre, and unconventional ideas in the most "new and astonishing rhymes." In his lyrics, in *Atalanta in Calydon*, and in *Tristram of Lyonesse*, one sees Swinburne at his best; but his Mary Stuart tragedies form, perhaps, the grandest part of his work.

Other poets of the Victorian age include the classic Walter Savage Landor, Philip James Bailey, A. H. Clough, and Matthew Arnold, during the earlier and middle years; Coventry Patmore, Monckton Milnes (Lord Houghton), Edward Fitzgerald (of "Omar" fame), Mrs. Browning, Rossetti and his sister Christina, and William Morris follow; while still later we have Sir Lewis Morris, W. E. Henley, John Davidson, Arthur O'Shaughnessy, Francis Thompson, William Watson, Alfred Noyes, Henry Newbolt, Stephen Phillips, and the Laureate, Alfred Austin.

The Victorian dramatists include Talfourd, Sheridan Knowles, R. H. Horne, Lord Lytton, Robertson, H. J. Byron, and Sir Henry Taylor; these were followed by a newer school, among whom are Henry Arthur Jones, Pinero, and Sidney Grundy: while still later we have the school of which G. B. Shaw, St. John Hankin, and John Galsworthy are the chief exponents.

The miscellaneous literature during the period is worthily headed by the *New*, or *Oxford*, *English Dictionary*, the *Dictionary of National Biography*, the *English Dialect Dictionary*, the later editions of the *Encyclopædia Britannica*, the *Encyclopædia Biblica*, and H. D. Traill's *Social England*. Education has progressed rapidly, with the result that an enormous literature of school-books, manuals,

educational treatises, and reprints of the classics has sprung up. The same may be said of periodical literature. Beginning with *Fraser* and *Blackwood*, coming down to the days of the *Cornhill*, *Temple Bar*, and *Macmillan's*, and culminating with the *Fortnightly* and *Contemporary Reviews*, the *Nineteenth Century and After*, the *Hibbert Journal*, and the *English Review*, we pass on to a flood of lighter literature in the *Strand*, *Cassell's*, *Pearson's*, and a host of others. Indeed, it may be said that there is no person, no profession, no trade, no sport, which does not find itself catered for by one or other of our periodical publications; while the daily and weekly newspapers have fully kept pace with the growing demands for news and reading matter, and have, in many cases, adapted themselves to the changes which have been stealing over the reading public.

This sketch indicates the extent, all-embracing nature, and excellence of that literature which, after thirteen centuries or more, stands confessedly first among the literatures of the moderns.

Englishry. During the Danish rule in England, when a murder was committed unless a "presentment of Englishry" could be sustained—i.e. unless the deceased could be proved to be an Englishman—the hundred in which the murder occurred was punished.

Engraving means cutting into an object, such as a block of wood or plate of metal, so as to leave a design on the surface. Early engraving was limited to two processes—cutting lines on a smooth surface, so that the design remains sunk; or cutting away until the design is raised and left in relief. Both have been practised since the dawn of civilisation. In the British Museum a small porphyry object, engraved with the name of Sargon, King of Assyria, in 3750 B.C., bears almost the earliest date known. In the first process, if the plate is smeared with ink the design will print *white*; by the second, the design will print *black*.

The first process is that followed in line-engraving, sometimes known as "intaglio" or "taille-douce"; the second principally for wood-engraving. It is uncertain at what time it occurred to anybody to multiply impressions of a design engraved by one of these processes. Wood-engraving was undoubtedly the process first employed for this purpose. It is known that the practice of multiplying impressions on paper from a wood-block was carried on in China and Japan at a very early date in our era. There are in the British Museum some slips of printed prayers in Japanese which can be safely referred to the 8th century A.D. It would appear that designs were impressed on stuffs for ornament by a similar process at an early date in Europe. Wood-engraving may have been practised in the 14th century; but it is not till the middle of the 15th century that any form of engraving for the multiplication of printed designs can be classed among the fine arts. The earliest pictorial wood-engravings were small images of saints (*Heiligen* or *Helgen*), rude in design and execution, such as are sold at church

doors or during religious festivals, and playing-cards, for which priority is sometimes claimed. The earliest print with a date, is a *Virgin with the Infant Christ and Saints* in the Royal Library at Brussels, which bears the date of 1418. This date has, however, been suspected, while the date of 1423, which appears on a print of *St. Christopher* pasted in the cover of a volume in the Althorp Library, has been universally accepted as genuine. It is probable that some existing prints of this class, undated, may be of an earlier date. Such prints were chiefly produced in Bavaria, Swabia, the Lower Rhine districts, and the Netherlands. The earliest playing-cards, however, appear to have been manufactured in France. As the practice of printing such pious subjects increased, it became usual to add explanatory or allusive texts, sometimes of great length. By engraving a number of such blocks of the same size with a series of consecutive subjects, and pasting them back to back, small volumes were formed known as "block-books," which appear to have been mainly used for the instruction of the unlearned. Among these "block-books," were the *Ars Memorandi*, *Ars Moricandi*, *Biblia Pauperum*, etc. A happy discovery led not only to the separation of the picture from the text, but also of the individual letters of the text. This invention of printing from movable types is what is generally known as the invention of PRINTING (q.v.)—perhaps the most important that the world has yet seen. Woodcut illustrations are associated with some of the earliest publications of the press. Certain prints of this date, in which the ground is shaded with a number of dots, known as the "manière criblée" or "Schrotblätter," appear to have been taken from metal blocks, engraved like wood blocks in relief.

Line-engraving for pictorial purposes has been generally supposed to have been invented not earlier than the middle of the 15th century, and to have been an accidental product of the goldsmith's craft. Recent researches have, however, shown that the works of an engraver in Germany, who is mainly known for an interesting series of playing-cards engraved on copper-plates, must be dated not later than 1430; that there is no reason to suppose that this engraver was the discoverer of the art; and that other copper-plate engravers in Germany trod closely on his footsteps, a series of small engravings of the *Passion* (in the print-room at Berlin) being dated 1446. Copper-plate engraving also first brings the art of engraving to rank among the fine arts, through the works of an engraver, who is only known by his initials "E. S." and the dates 1466-1467, which appear on some of his later prints. His works show not only great technical skill, but great beauty of design and intensity of conception.

Such engravings as these were mainly executed with a stiff, sharp instrument, known as the "burin," which ploughed a line in the copper: some of them, however, show the use of a finer, needle-shaped instrument, known in later days as the "dry point." The earliest exponent of this latter method was an anonymous engraver, who lived before and about 1480, and is known as the "Meister des Hausbuch." The bulk of this artist's engravings, which are

sometimes extremely realistic in conception, are preserved in the national collection at Amsterdam. The first great personality in the history of engraving is Martin Schongauer (born at Colmar in Alsace about 1450, died at Mülhausen, 1491), who was both painter and engraver. His works are not only technically perfect, but are full of poetical and religious inspiration, though trammelled by the stiffness of design prevalent at that date. His immediate successor was Albrecht Dürer of Nuremberg (1471-1528). The popularity of these early engravings is illustrated by the fact that the works of two of the most prolific engravers at this date, Wenzel von Olmütz and Israhel van Meckenem, consist almost entirely of copies from the most important engravings from the master "E.S." down to the early works of Dürer. By Dürer (q.v.) the art of engraving was advanced to a very great degree. He, too, was the first to practise for pictorial purposes the art of *Etching*, whereby the work of the graver was effected by the action of a corrosive acid, a process long practised by armourers for decorative purposes in their craft. Wood-engraving, too, flourished under Dürer. It is almost certain that Dürer and other great artists did not habitually cut the wood-block themselves, and that the wood-engraver remained for a long time a mere mechanical craftsman. This art came about 1490 to the fore by the employment for the first time of first-rate artists as designers. The chief result of this was a folio book giving a chronicle of the world's history, published at Nuremberg in 1492 by Hartmann Schedel, and known as *The Nuremberg Chronicle*, for which the illustrations were drawn by Michel Wolgemut, the master of Dürer, and W. Pleydenwurff, both painters of note at Nuremberg. Unfortunately the want of skill in the engravers destroyed much of the beauty of the original drawings, as may be seen by comparing the engraved frontispiece to the book with the original drawing for the same, which is preserved in the British Museum. Under Dürer a better class of engravers rose. Italy for a long time claimed the honour of the invention of copper-plate engraving. According to tradition one Maso Finiguerra, a goldsmith at Florence, while working in 1452 on an engraved "Pax," ornamented with niello [NIELLO], discovered by accident that lines hollowed out of a metal plate and filled with black pigment would give an impression on a white surface, and thus executed a beautiful print from a "Pax," which is now at Florence, of which there is an impression in the National Library at Paris. That Finiguerra discovered how to take impressions on paper from niello plates during the progress of their execution need not be doubted, as many prints exist taken from such plates. It has been shown, however, that copper-plate engraving was already in full practice many years before Finiguerra's discovery. Moreover, niello plates were for ornament, and not to be used in printing, so that all impressions from true niello plates should have the design in reverse, since for the purposes of printing all designs are engraved in reverse on the plate or block itself. It is not till 1480 that an Italian school of engraving can be said to have existed. About that time a few

engravers practised at Florence, obviously from the designs of Botticelli, Filippo Lippi, Pollaiuolo, and other great Florentine artists, who in some cases are credited with having practised the art with their own hands. These Italian prints show as great technical excellence and a great deal more beauty of form and design than those of the contemporary engravers in Germany, but there are distinct traces of northern influence in some of the early Italian prints. The earlier Italian engravings, such as the illustrations to the *Dante* of 1481, the *Prophets and Sibyls*, the *Tarocchi Cards*, etc., have been roughly classed under the name of a possible, but unauthenticated engraver, Baccio Baldini. One of the great painters who practised engraving himself was Andrea Mantegna, who has left some important works in copper-plate engraving, executed in a peculiarly powerful and individual manner. The art was practised by other well-known artists, such as G. Moccetto, the Campagnolas, the Francias, among whom perhaps the most interesting is Jacopo de' Barbari, who was a native of Venice, but lived for some time in Germany, and was also in the royal service in the Netherlands. Barbari was a strong individual genius, even strong enough to have a powerful influence on the ripening mind of Dürer. Copper-plate engraving in Italy reached its highest point in Marc Antonio Raimondi, whose first public appearance was as a pirate of engravings by Dürer, but who attained higher renown as an exponent and translator of drawings and paintings by Raphael, Giulio Romano, Bandinelli, and others. Marc Antonio inaugurated a school of engraving of great excellence, among his followers being Agostino Veneziano, J. Caraglio, the Ghisi and Scultore families, Marco Dente of Ravenna, Giulio Bonasone, Enea Vico, and others. It was during this period that the engraver's art began to be employed for the most part in reproducing the drawings or paintings of other artists. The facility with which well-known works of art could thus be circulated and made accessible to the multitude caused this practice to be developed to an unlimited extent in subsequent ages, so that at the present day there are many who believe this to be the sole and original aim of the engraver.

Wood engraving as an art was introduced into Italy in connection with the printing-press by German artists in 1465 with considerable success.

In the Netherlands, where wood-engraving, as stated before, was practised at an early date, copper-plate engraving found its first great exponent in Lucas van Leyden, who commenced engraving in his boyhood, and produced a great number of engravings, which are pre-eminent for delicateness of execution, wealth of imagination, and the realism, which has always characterised the art of the Low Countries. Like Dürer, Lucas van Leyden, though distinguished as a painter, found the true outlet for genius in the art of engraving.

One mode of engraving popular at this date, for the inventor of which Germany and Italy contend, was that of *chiaroscuro* (*camaieu*), wherein by superimposition of two or more wood-blocks, smeared with different colours, the effect of a

coloured engraving was produced. This was much in vogue in Italy in the 16th century, but then died out, and after a few attempts to resuscitate it at later dates, the principle was adopted and carried to great perfection in our modern chromolithography. In Germany the influence of Dürer was widely felt in all branches of engraving. At Nuremberg a school of engravers was formed, who are known as the "Little Masters," owing to the very small size of their engravings. This minuteness, which led to the exercise of very remarkable skill, was due to the fact that the goldsmiths and armourers had recourse to engravers for models of ornament with which to decorate their manifold productions. These "Little Masters" were Hans Sebald and Barthel Beham, H. Aldegrever, A. Altdorfer, J. Binck, G. Pencz, and Virgil Solis. The school of Dürer also produced excellent engravers in Augustin Hirschvogel, Hans Ladenspelder, etc. Wood-engraving, too, flourished greatly, being carried on in the Dürer manner by Hans Schüpflein, Hans Springinklee, and others at Nuremberg, and at Augsburg by Hans Burgkmair. Augsburg became one of the principal centres of engraving under the auspices of the art-loving Emperor Maximilian, to whose munificence are due such great productions in wood-engraving as *The Triumphal Arch* by Dürer, the illustrations to *Theuerdänckh* by Schüpflein, the *Weiss Kunig*, and *The Triumph of Maximilian* by Burgkmair and others. From Augsburg also came the Hopfer family, who practised the art of etching with great success. Saxony produced a great and original artist in Lucas Cranach, equally distinguished as painter, engraver, and draughtsman on wood.

In Switzerland a school of engravers grew up, who practised principally at Basle, chiefly in connection with the printing press, and many notable works in engraving were produced by Urse Graf, Nicolas Manuel Deutsch, and others, including Hans Holbein the Younger, whose designs for the Bible and the *Dance of Death*, as cut on the wood by Hans Lützelburger, remain perhaps to this day the high-water mark of engraving. Subsequently, the art of engraving grew weaker throughout Germany along with a general decay of artistic impulse, and it was chiefly confined to interests of a servile and commercial nature of little artistic value. The engravings of Cranach and Holbein had a large share in preparing the minds of the uneducated classes for the new era of the Reformation.

In Italy the school of Marc Antonio was succeeded by a number of artists who practised engraving, especially etching, with extreme facility and frequent beauty of execution. The shallow grace and feeble conceptions of the Carracci, Guido Reni, Parmigiano, Primaticcio, and their contemporaries were strongly shown in the engravings of their school. Under their influence the art of engraving ripened rapidly, withered, and then sank to almost complete extinction. When Germany and Italy failed to maintain the art of engraving at its former excellence, the other countries took their place. Foremost among these come the Netherlands.

At Antwerp the family of Wierix carried on the Dürer tradition with great skill. They and their

successors, the Galle family, the Collaerts, and others, formed a large school, whose technical abilities were exercised most prolifically on the countless designs of a religious nature commanded and circulated by the Jesuits not only in Europe, but in all parts of the inhabited world. As in the days of the Reformation mentioned above, engraving became a language through which to reach the minds of the uneducated. At Antwerp also a school of first-rate engravers sprang up, mainly devoted to the translation of pictures by Rubens (under his immediate supervision), Van Dyck, and their immediate followers; noteworthy among these were Scheltius and Boetius van Bolswert, Paulus Pontius, and Lucas Vorsterman the elder. Engraving became at this time extensively practised throughout the Netherlands, and nearly every town supported one or more engravers of eminence. Holland produced first-rate artists in Hendrik Goltzius, Jan Muller, J. Sacreduan, the Matham family, Cornelis and Jan Visscher, J. Suyderhoef, the Van de Passe family (who worked Utrecht and Cologne), and others. It was in etching, however, that the Netherlands attained their greatest eminence. The few untouched etchings left by Van Dyck are models of invention and refinement. Rembrandt van Ryn (q.v.) carried both painting and etching to the highest point: his etchings are among the art-treasures of the world.

Holland produced at the same time as Rembrandt, in an almost bewildering number, original exponents of the art of etching, some of whom—such as Adrien van Ostade, Paul Potter, N. Berchem, J. Livens, Carel du Jardin, with many others—are worthy of being classed in the first rank. By the end of the 17th century the supply ceased, and from that date few works of interest were produced in the Netherlands, where, as in other countries, the art of engraving was limited to the mere illustration of books or to producing of cheap copies of popular works of art. Bernard Picart, a Frenchman, established a large business at Amsterdam in the 18th century, whence countless engravings of this class were issued. Jacob Houbraken is well known for his numerous engravings of portraits, executed from originals in England. Wood-engraving became largely employed for advertisements, cuts in newspapers, etc., usually on a small scale.

In France the art of engraving was acclimatised with some difficulty. At the end of the 15th century wood-engraving had been introduced in connection with the printing-press, and the books issued by the publishers Simon Vostre, Antoine Vêard, and others were adorned in a very beautiful way with small cuts, executed in the dot manner (*manière criblée*), and engraved in relief on blocks of metal. Wood-engraving never really flourished in France, the most noteworthy examples being the engravings from the designs of Bernard Salomon ("le petit Bernard"), published at Lyons during the latter half of the 16th century.

Copper-plate engraving was practised in France early in the 16th century by Geoffroy Tory, Jean Duvet, Jean Cousin, Jean de Gourmont, and others, but without giving much impulse to the art. Some engravers like Nicolas Beatrixet and Niccolo della Casa went to Italy, and wasted their skill under the

Italian influence of the decadence, and the same influence was exercised on a school of artists at Fontainebleau. A school of engravers at Paris based themselves on the tradition of the Wierix family at Antwerp, and certain engravers like Thomas de Leu and Leonard Gaultier showed great technical excellence, especially in the engraving of portraits. Goldsmiths profited largely from the engravings of Etienne Delaune, who worked in a style similar to that of the "little masters" in Germany, of Pierre Woëriot and a few others. With the 17th century engraving in France began not only to be very widely practised and patronised, but also to develop that peculiar technical skill, especially in the rendering of portraits and pictures, which for the next hundred and fifty years made Paris the centre of the engraver's art. Pierre Daret and Michel Lasne were the inaugurators of this period, with Claude Mellan, who endeavoured to reduce the labour in the process of engraving by confining himself to the contours of a single line, in which manner he produced some remarkable achievements in engraving, but found few, if any, imitators. Abraham Bosse, who wrote a treatise on engraving, showed himself technically a master of his art. Jacques Callot is, perhaps, the first great original painter-engraver in France, though much of his life was passed in Italy. Both in line-engraving and etching he produced an immense number of engravings, many on a very minute scale, the popularity of which has been maintained to the present day. Stefano della Bella, whose numerous etchings show a light and dexterous touch, though a native of Italy, passed a great part of his life in France. Another great artist, who worked in both countries, was Claude Gellée (Lorraine), whose etchings contain something of the glamour which is found in his paintings, and who found many imitators in his Italianised style of landscape-etching. During the long reign of Louis XIV. Paris was crowded with engravers of great merit chiefly occupied in translating the paintings of the great French painters. Among them were the Audran family, G. Edelinck, F. de Poilly, and many others.

The engraving of portraits was carried at this time to great perfection, the portraits of the period lending themselves handsomely to the burin of R. Nanteuil, J. Morin, A. Masson, the Drevets, and P. van Schuppen. Towards the end of the century the prevailing exuberance of taste in ornament produced a great number of engravings devoted to that purpose from the designs of J. Berain, J. Le Pautre, etc. The 18th century found engraving still flourishing in France, large schools of engraving being formed in Paris under J. P. Le Bas, F. F. Basan, and other well-known engravers, who issued numerous publications containing engravings from the pictures in the great private galleries of royalty and the nobility. Watteau, Lancret, and the "galant" painters of the reign of Louis XV., gave occupation to engravers whose admirable skill was often wasted on the frivolity and questionable nature of their subjects. Book-illustration and ornament also became one of the features of the time, the publishers vying among themselves to

secure the ablest engravers to reproduce the exquisite book-plates and vignettes of Eisen and Gravelot. Among the engravers of this class may be noted J. M. Moreau and P. Choffard.

New methods of engraving were invented about this time. Colour-printing, which had been extinct since the days of the old chiaroscuro engraver, was revived with the employment of mezzotint engraving by J. C. Le Blon and carried on by his pupils for a time, but without much success. A more successful method was adopted by Bonnet, Janinet, Descourties, and others, and carried to perfection in later days by L. P. Debucourt, whereby some delicate and agreeable engravings in colour were produced, which are highly valued by connoisseurs. Demarteau invented a process of engraving in colours to imitate chalk-drawings, and J. B. Leprince was the first to practise aquatinta or lavis engraving, which afterwards proved so useful for topographical purposes. Line-engraving during the 18th century in Paris was usually based on a groundwork of etching.

In England copperplate-engraving was practised in the 16th century by a few foreigners and one or two native engravers, dating from the early years of the reign of Queen Elizabeth. Archbishop Parker was the first in England to give regular employment to engravers, who were mainly employed on topographical work and portraits. In the reign of James I. two members of the Van de Passe family came over from Utrecht and worked at portraits, having various imitators such as R. Elstracke and F. Delarain. Subsequently the art of such engravers as William Marshall and T. Cecil was almost entirely employed on frontispieces and illustrations of books. Wenzel Hollar, a Bohemian by birth, executed a great part of his numerous etchings in London, and he left a few pupils, such as R. Gaywood, who imitated his method, but with indifferent success. The first great native engraver in England was William Faithorne, who, however, derived some of his skill from his training in France under Nanteuil. The middle of the 17th century was remarkable for the invention of mezzotint engraving [MEZZOTINT ENGRAVING], which, although invented by Ludwig von Siegen in Germany in 1642, was not really developed until its introduction into England by Prince Rupert, who with Wallerant Vaillant, A. Blooteling, and a few English artists brought it to perfection and to such popularity that it became known as the "English manner." This process was chiefly devoted to portraits, and countless portraits by Lely, Kneller, and their contemporaries have been thus preserved to posterity. For a time mezzotint-engraving rather superseded line-engraving, but David Loggan engraved many important works in topography and in portraiture, and in the latter line was ably followed by his pupil, Robert White. G. Vertue at the beginning of the 18th century was a prolific engraver of portraits, topography, antiquities, etc., and was followed by the Basires and other engravers of a formal and uninteresting nature. William Hogarth engraved many of his own compositions in a somewhat dry manner, but with great technical excellence. A more distinctly

national impulse was given to engraving by the works of Sir Robert Strange, William Sharp, and William Woollett, whose technical skill was of the highest order. They were followed by a group of landscape engravers including F. Vivares, J. Browne, J. Mason, etc. Engraving was demanded very extensively for book illustrations, historical pictures, and the like; but the style of the English line engravers at the close of the 18th century became monotonous and conventional, and their works excite but little enthusiasm. Much greater attention was drawn to the newly-developed art of stipple-engraving, of which F. Bartolozzi was the chief exponent, and the sweet but rapid designs of Angelica Kauffmann, G. B. Cipriani, and R. Cosway were the principal subjects.

Mezzotint engraving was brought to a high pitch of perfection under Sir Joshua Reynolds, many portraits painted by him being engraved by this process. McArdell, J. R. Smith, Valentine Green, R. Earlom, W. Dickinson, were among the most noteworthy engravers at this date.

Early in the 19th century a new impulse was given to line-engraving in Italy, a school of engravers in the pure line manner being formed at Rome by Volpato and Raphael Morghen, who engraved many of the best works of the old masters; a similar school was established under P. Toschi at Parma, devoted to engraving the works of Correggio, and their influence spread to Germany, where many similar engravings were produced. Technically the engravings of this date are of the highest excellence, but, being monumental in their nature, they are to a certain extent cold and unattractive. In England the discovery of covering the copperplate after engraving with a light coating of steel, gave for a time a great impulse to the art of engraving, since the number of impressions, which can be taken from a steel plate with but slight variations of excellence, is almost unlimited. For a time books illustrated with engravings of this kind were greatly in vogue, but latterly the line-engraver has been almost entirely occupied in reproducing on a large scale the works of contemporary and popular artists. J. M. W. Turner in his *Liber Studiorum* combined etching and mezzotint, and many fine engravings were made by other engravers from his paintings. D. Lucas produced some fine mezzotint-engravings from paintings by J. Constable, under the painter's immediate supervision. Sir Edwin Landseer owed much of his popularity to the skill of his brother, Thomas Landseer, as an engraver. The introduction of photography, and the various processes resulting from it, gave, to a certain extent, a death-blow to engraving everywhere. Mezzotint engraving almost entirely perished, though a few attempts to revive it have been made at the present day. Etching, on other hand, was revived in France as an original art with great success by C. Méryon, Bracquemond, Lalanne, and other artists of note. The impulse thus given by them reached England and even America, the chief exponents of the art in the former country being Seymour Haden and J. McNeil Whistler, under whose influence the art has fought its way into the front rank.

Wood-engraving also in the 19th century took a fresh lease of life under Thomas Bewick of Newcastle, who abandoned the old process of engraving in relief for a form of intaglio engraving in wood, which was adopted extensively throughout the world, and with which his name is inseparably connected. To his process of wood-engraving is due the illustration of newspapers and periodicals before the "process" (ILLUSTRATION) blocks came into almost universal use. Lithography cannot strictly be classed as a process of engraving. When the Royal Academy was founded, engravers were admitted into the ranks of the academicians. At the present day, however, the art of engraving, with the exception of etching, has too far ceased to be concerned with original production, and is not sufficiently free from mechanical assistance, to enable it to maintain its position among the fine arts.

Engrossing, the fair copying of a deed or other instrument for execution, words and figures being written in full. As regards conveyances and other documents relating to freehold lands and probates of wills, the old style of engrossing is largely retained, though it is not now compulsory, and it is rapidly giving way to the ordinary hand-writings. [DEED.] In criminal law engrossing was the offence of buying up large quantities of corn, etc., with intent to resell. It was abolished by a statute passed early in the reign of Queen Victoria. In the United States it is a common law offence.

Enlisting is an engagement or undertaking to serve as a private soldier or sailor, either for an indefinite time, or for a certain fixed time, on receipt of pay therefor. It is voluntary, and in that respect differs from enrolment, which is compulsory, or at least is so under some circumstances, as in the case of men who were formerly selected by ballot for the Militia, or by the conscription for military service on the Continent. The statutes which regulate the enlistment, etc., of soldiers, are the 42 & 43 Vict. c. 33, amended by the "Regulation of the Forces Act, 1881," and repealed and re-enacted with amendments by the "Army Act, 1881," which last statute is directed to come into force during the continuance of an annual Act to be passed for that purpose, but for no longer period; and to be subject, moreover (when so brought into force), to such provisions as may be specified or referred to in the annual Act. In this military code provision is made for the manner in which the troops are to be enlisted, and "billeted"—i.e. dispersed among the several innkeepers and victuallers throughout the kingdom, and regulations are therein laid down for the government of the Army, and for every person subject to military law. As to sailors, the practice is closely analogous to that established for the government of the Army—the scheme of naval discipline (comprised in what are known as "The Articles of the Navy"), was embodied in a statute of Geo. II. (amended by subsequent Acts), and is now laid down in the "Naval Discipline Act, 1866," which is, like its predecessors, permanent in its character, and does not require (as in the case of the Army) to be brought

into force by an annual Act. This curious distinction probably arose from the perpetual establishment of the Navy, which rendered a permanent law for its regulation expedient as against the temporary duration of the army.

Enniskillen, a market town, and previous to 1885 a parliamentary borough, in the county of Fermanagh, Ireland, 84 miles N.E. of Sligo, on an island in the river that joins Upper and Lower Loch Erne, having a suburb upon each bank, to which it is joined by two bridges. The principal industries are tanning and brewing, and there is considerable trade. The town gives its name to a regiment of dragoons.

Ennius, QUINTUS (239–169 B.C.), a Latin poet, born at Brundisium. Cato the Censor brought him to Rome at the mature age of 38, and here he gained the friendship of the leading men and taught Greek. To a knowledge of Greek he added a thorough acquaintance with Oscan and Latin, and his writings seem to have helped to fix the Latin tongue. In another way he was the Spenser of Rome, for he was a "poets' poet," and the affectionate epithet applied to him was "Ennius noster." Of his many writings—epic, comedy, tragedy, annals, etc.—only fragments remain.

Enns, a river of Austria rising in a branch of the Noric Alps in Salzburg, 12 miles N. of Ratstadt. It flows N. to Ratstadt, then N.E. across Styria and N.W. into Austria, which it divides into Upper and Lower, and falls into the Danube, somewhat below the town of Enns, after a course of 160 miles, the lower part of which is navigable.

Ensign, a word formerly used in the English army to denote a junior rank of commissioned officers in an infantry regiment, one of whose duties was to carry the Queen's and the Regimental colours. The name is now abolished, and the title of second lieutenant substituted for it. In naval phraseology the ensign is the national flag, which is exhibited at the stern of a vessel. Both officer and flag were formerly called "ancient"; and this word is used in Shakespeare to denote the officer, and in old books of travel to denote the flag.

Enstatite, one of the "rhombic pyroxenes," silicates of iron and magnesia related to augite (q.v.), but crystallising in the Rhombic (i.e. Prismatic) system. They differ in the percentage of iron they contain, Enstatite having less than five per cent. In thin sections it is colourless and not pleochroic. It gives its name to varieties of diorite and dolerite. It is slightly pearly in lustre, almost infusible, has a hardness of 5.5, and a specific gravity of 3.1 to 3.3.

Entablature, in *Architecture*, continuous work resting upon columns, and sometimes consisting of architrave, frieze, and cornice.

Entail. [ESTATE-TAIL.]

Entalophoridae, a family of Bryozoa, belonging to the order Cyclostomata (q.v.), and including a number of forms with erect, branching shoot-like colonies with the separate polypides or individuals of the colony opening on all sides of the axis.

Entellus (*Semnopithecus entellus*), a monkey highly venerated by the Hindoos. [HANUMAN.] It is naturally confined to the right banks of the Ganges and Hooghly, but has been introduced elsewhere by the natives. It is of large size, with the tail longer than the body, ash-grey above, dingy yellow below, the tints deepening with age. The dusky face has a fringe of white hairs. Like some other monkeys, it is revered as a possible host of ancestral souls, and on that account is allowed to commit depredations unchecked.

Enteric Fever. [TYPHOID.]

Enteritis, acute inflammation of the intestines, may be caused by mechanical injury or by the ingestion of irritating substances; again it usually complicates such diseased conditions as exist in strangulated hernia, intussusception, and other forms of intestinal obstruction. [INTESTINES.]

Enterocoele, one of the best-known types of body cavity (q.v.); it is formed from an outgrowth from the primitive cavity in the larva. It occurs in the Echinodermata, Brachiopoda, *Sagitta*, *Balanoglossus*, and *Amphioxus*.

Enteropneusta, the class of worms which includes *Balanoglossus*, a genus well known in connection with the speculations as to the ancestry of the Vertebrates. The characters of the group are given under *BALANOGLOSSUS*.

Entomostraca, one of the two sub-classes of the class Crustacea, including small and simply organised forms, in which the number of somites and appendages is very variable, whereas in the Malacostraca (q.v.) the number of somites is always 19. There are four orders of Entomostraca—(1) the Phyllopods, with elongated, segmented bodies, protected by a shell; (2) the Ostracods, small unsegmented forms with bivalved shells; (3) the Copepods, long and segmented but shell-less; and (4) the Cirripedia, including the fixed, imperfectly segmented barnacles and acorn shells. The Entomostraca are mainly marine, but many of the Phyllopods as *Daphnia* and *Apus*, of the Ostracods as *Cypris*, and of the Copepods as *Cyclops*, are fresh-water; *Ethieria*, a Phyllopod, is estuarine. The sub-class commences in the Lower Silurian. Reference should be made for further particulars to each of the four orders.

Entoprocta, a sub-class of Bryozoa (q.v.), including the four genera *Loxosoma*, *Pedicellina*, *Acopularia*, and *Urnatella*, and possibly also *Barentsia*. They are by far the simplest class of the Bryozoa, and even the adults are really in the stage of the larval form, known as the Trochosphere (q.v.). They have no body cavity, have one pair of nephridia or renal organs, and the sexes are united in the same individual. The main character of the class, however, is that the anus and mouth are both included within the circlet of arms. No fossil representative of the class is known.

Entozoa, a term once used to include those worms which are internal parasites, such as the Flukes, Tapeworms, Hair Worms, etc. As, however,

the adoption of this division necessitated the division of such a class as the Nematoids or thread-worms, it has been abandoned. [FLUKE, TAPEWORM, ACANTHOCEPHALA, and NEMATOIDEA.]

Entre Douro e Minho, or MINHO, a province in the N.W. of Portugal, having the Minho on the N. and the Douro on the S., with an area of 2,800 square miles. There are three districts—Braga, Viana, and Oporto, the last being the capital and the port from which the wine of the district is shipped. The province also produces oil, flax, cereals, and vegetables, and the fisheries of the coast are important.

Entrenchments, a term of military engineering used to denote a set of defences and protections of a force, formed, as the name implies, by excavating the ground and serving both as an obstacle to the enemy's advance and, if necessary, as cover and protection for the defenders. When used as a covered approach to a place besieged, the excavations made are commonly called "trenches."

Entre Rios (*between rivers*) is a province of the Argentine republic between the Uruguay in the E. and the Parana in the W. and S., and having the province of Corrientes to the N. It contains about 45,000 square miles, and consists in the southern part of a low-lying, alluvial plain, subject to inundation, and in the northern of undulating land with large swamps covered with small timber, but containing fine grass and pasture lands, and occupied by estancias (farms), which rear about four million horned cattle. The climate is good, but there is little cultivation. There are many tributaries of the two rivers mentioned above. The chief productions are hides, horn, tallow, and charqui (jerked or dried beef). Concepcion is the capital.

Entropion, or ENTROPION, a turning-in of the edge of the eyelid, due to muscular spasm, or to cicatricial contraction supervening upon a wound of eyelid. In entropion the eyelashes are turned inward, and, rubbing against the cornea, produce intense irritation. The condition if neglected may lead to considerable loss of vision.

Entropy, in the theory of heat, is a special property of the heat in a body. It measures that part of the energy in the body or system of bodies which cannot be converted into work, though it is not identical with the unavailable energy. In every heat transfer from bodies at higher temperatures to bodies at lower, the available energy is diminished and the entropy increased. In all such transfers the entropy tends to a maximum. [HEAT, ENERGY.]

Envelope, in *Geometry*, means the line or surface formed by small portions of a series of curves or curved surfaces, such that if a point travels along the line or surface, it will at any instant be travelling tangentially to one of the series. If a great number of equal circles be drawn all passing through one point, their envelope will be a circle of double the linear dimensions and with its centre at the given point. Or if a great number of straight lines be drawn in a plane, all

at the same distance from a given point in it, they will envelope a circle with that point as centre.

Envelopes, in a technical sense, are the covers used to protect letters sent by post or otherwise, to secure them from observation. Till comparatively lately the envelope was unknown, a letter being written upon a sheet, whose outside was left blank and which was folded over so as to form a space for the address. The post office sells envelopes with embossed stamps upon them. Among the early designs was the Mulready envelope, which is now an object of curiosity for collectors. New varieties of envelope are frequent.

Environment, a convenient collective term employed in biology for the conditions of existence, or inanimate and animate surroundings, among which an organism lives. The opinion is gaining ground that this environment has had a leading influence in producing adaptive modifications of organisms by its direct actions. Geoffrey St. Hilaire in 1795 and Lamarck (q.v.) in 1801 attributed much to what the former termed "*le monde ambiant*," as did Robert Chambers in the *Vestiges of Creation* (1841). Mr. Herbert Spencer has always done so; but Darwin at first laid far more stress on inherent variability. Drs. August Weismann and Karl Semper have since insisted on the paramount influence of the environment on animals, as has the Rev. George Henslow in the case of plants. Food, light, temperature, movement and salinity of water, dryness or moisture of the air, among inorganic influences, and the action of parasites (q.v.) or of similar competing organisms, among those that are organic, contribute to this environment. The absence of colour in cave animals and its uniformity in other cases, as in the "sabbelline" or sandy hue of desert animals, have been attributed to the direct action of the environment. "Melanic," or dark, varieties are said to be connected with increased atmospheric moisture; even the origin of flowers is explained by the response of the plant to mechanical irritation by insects.

Envoy, a public minister sent upon some special business from one government or ruler to another. He thus differs from the ambassador, who permanently resides at the foreign court.

Eocene System, the lowest subdivision of the Tertiary group of sedimentary rocks, so named by Lyell (from the Greek *ēōs*, dawn; *kainos*, recent), because the mollusks in these rocks present the first specific approximation to those of recent times. From the Mediterranean basin to what are now the Pyrenees, Alps, Carpathians, and Caucasus, through Syria, Northern India, China, and Japan, open-sea conditions continued after the close of the Cretaceous (q.v.) epoch, and a massive limestone crowded with the characteristic foraminifer *Nummulites* (q.v.) was laid down. In Northern Europe the bed of the Chalk sea was raised so as to form several more or less distinct areas of deposit, and the outpourings of the great basalts of Auvergne, the Eiffel, Antrim, Mull, Skye, and Iceland probably began. In Britain Eocene rocks are confined to the two centroclinal basins in the

Chalk, known as the London and Hampshire Basins. Paris is situated on a similar basin. Both the plants and the animals they contain point to a climate almost tropical. Palms, nautili, cone, volute and olive shells, turtles, crocodiles, and sea-snakes indicate this. Besides sharks and a few birds, Eocene beds have yielded a variety of mammalian remains, especially interesting from their generalised character, combining, as they do, features of various groups now distinct. Such are the *Tillodontia* (q.v.) and *Eohippus*, the small ancestor of the horse, from the western United States, the tapir-like *Palaotherium* of Europe and the lemuroid *Cenapithecus*. The British Eocenes may be divided as follows:—

Hampshire.		London Basin.
Upper—	Barton Clay.	Upper Bagshot Sands.
Middle—	Bracklesham, Bourne- mouth, and Alum Bay beds.	Middle Bagshot Sands.
Lower—	Bognor Clay.	Lower Bagshot Sands.
		London Sands.
	Woolwich and Reading Clay.	London Clay.
		Woolwich and Reading Clay.
		Thanet Sands.

The lignites associated with pipe-clay in an old lake-basin at Bovey Tracey in Devonshire, and some at least of those between the great basalt sheets, 900 feet thick in Antrim, 3,000 feet thick in Mull, and extending into Greenland, are assigned to this period. [BAGSHOT SANDS, LONDON CLAY, THANET SANDS.]

Eocystites, an obscure genus of Cystoids (q.v.) found in the Lower Cambrian rocks; it is of interest as the oldest known Echinoderm.

Eon de Beaumont, CHARLES (1728-1810), a French adventurer, sometimes known as the Chevalier d'Eon. Having attracted notice as a political writer he was sent on a secret mission by Louis XV. to St. Petersburg, where, disguised as a woman, he obtained much influence over the Empress Elizabeth, and advanced the views of the French Court. The next year he returned to St. Petersburg in man's dress, and professed to be the brother of his former self. He did other diplomatic work, and after a period of service in the army he was appointed Minister to the British Court. Falling into disgrace at the French Court, and being superseded and outlawed, he resided in England, where people were much exercised as to his sex, and in an action arising out of a bet the Court of King's Bench ruled that he was a woman. For a time he went back to France on condition of wearing woman's attire. He died in London.

Eoscorpis, a primitive type of Scorpion found in the Carboniferous rocks of Europe and America.

Eosin ($C_{20}H_9BrO_5$) (*Tetra-brom-fluorescein*), a bronze-coloured powder, which yields a fine red solution, and is the starting-point of a series of fine dyestuffs—the Eosin Dyes.

Eötvös, JOSEF (1813-1872), Hungarian statesman and author, was born at Ofen. He studied philosophy and law at the University of Pesth, and before 1831 had produced three dramas, one of which was a tragedy. He practised law for a short time, and then travelled in many countries of

Europe, and wrote upon prison reform in 1838. He formed a friendship with Kossuth, and became known as a journalist, and in the Diet. After the Revolution of 1848 he was Minister of Public Instruction under Batthyany, but he resigned and retired to Munich for three years. In 1851 he returned to Hungary, and in 1855 became Vice-President and in 1866 President of the Hungarian Academy. In 1867 he was again Minister of Public Instruction. A collection of his political writings was published in Leipzig in 1846. He also wrote some novels, *The Carthusian*, *The Village Notary*, and *Hungary in 1514*.

Eozoon, or the "DAWN ANIMALCULE," is a structure which often occurs where thin alternate layers of serpentinous and calcareous minerals are superposed and have been subjected to alteration. The interest and importance of this structure is that it was originally described as a fossil; and, as it occurs in a series of rocks probably of igneous origin, below the base of the lowest known sedimentary rocks, it was claimed as the earliest sign of life on the earth. It has thus attracted great attention, and an enormous literature has been devoted to it.

1. *The discovery.* It was first found in Canada, associated with the crystalline and igneous rocks assigned to the Lower Laurentian system, and was described in 1864 by Sir W. Logan, Sir J. W. Dawson, and Dr. Carpenter as a great Foraminifer (q.v.). It was found in many places in Canada, while a similar structure occurs among similar serpentinous rocks in Connemara, Skye, Bohemia, Bavaria, Trinidad, etc.

2. *The theory of its organic nature.* The typical specimens consist of irregular layers of some calcareous mineral (calcite or dolomite), separated by serpentine usually occurring as a series of rounded bodies. The former was regarded as the "intermediate skeleton" of a Foraminifer, while the serpentine was regarded as due to infiltration of the body cavities. The calcareous layer is usually traversed by a series of branching fibres, etc., which were regarded as casts of the canals which ramify through the skeleton of the higher foraminifera, such as the Nummulites; occasionally simple, short, and thicker bands or rods connect two calcareous layers; and these were compared to the "stolon passages," which connect adjacent body cavities of the Foraminifera. The serpentinous layers are often bordered by a narrow fibrous zone, which appears as if composed of innumerable minute tubes, and has thus been identified as the "nummuline layer" or proper wall. Dr. Carpenter admitted that each of these four structures can be matched among minerals, but he maintained that the association of the four proved an organic origin. Eozoon was, therefore, claimed as the remains of a gigantic Foraminifer, which lived at the bottom of the Laurentian sea, and was the oldest known fossil.

3. *The arguments for its inorganic nature* are twofold; in the first place, it occurs in rocks which were either formed directly by the consolidation of a molten mass or by the intense metamorphism of

other rocks; in the former case, no living being could have existed at the time of the formation of the rocks, and in the latter any fossils would inevitably have been destroyed. The *à priori* improbability of the discovery of fossils in these rocks is, therefore, very considerable. In the second place, it is maintained that all the structures present can be matched elsewhere in rocks, which are clearly inorganic, while they are really quite different from the Foraminiferal structures with which they have been compared. Thus, the supposed proper wall is merely a layer of chrysolite (a variety of serpentine), which is formed on the surface of the serpentine layers; the supposed canals appear to be dendritic minerals included in the limestone, while in the specimens selected by Dr. Carpenter as especially typical they have been shown to differ fundamentally in form, nature, and position from any possible organic canals. It, therefore, appears that the Eozoonal structure is due to the inter-lamination of some mineral which becomes altered to serpentine with layers of limestone. This might be caused either by the original deposition of grains of olivine in a limestone or by the formation of a zonal structure in an intensely altered limestone. One very weighty argument against the theory of the organic origin of Eozoon is that it is never found in ordinary limestones or clays, but always in association with minerals of an igneous origin; if it were a fossil, there would be no reason why it should be always found with alteration products of olivine. If a single specimen of typical Eozoon should be found preserved in limestone alone without any serpentinous minerals, then its organic nature could not be doubted. Sir J. W. Dawson claimed to have discovered such, but the "Tudor specimen," on which this claim was based, has recently been re-described and shown to be neither Eozoon nor in any way organic. At one time Eozoon was very widely accepted, but an overwhelming majority of recent writers have now decided against its organic origin. The recent work of the Canadian Geological Survey, and notably that of Dr. Lawson in the area of Rainy Lake, has shown that the whole of our views upon the Laurentian rocks must be reconsidered.

Epacts (literally *epaktai hēmerai*, added days), in ecclesiastical reckoning of time, denote the excess of the solar month over the lunar month, or of the solar year over the lunar year. There are two systems by which the epacts are calculated. The later is the Gregorian Calendar of Epacts, which fixes them independently of sun or moon. The older or Italian system took the solar year as consisting of 365 days and the lunar of 354, the difference being 11 days. Every third year an intercalary lunar month of 30 days was put in, which reduced the difference to 3 days, which the addition of 11 days increased to 14. This process was continued for a cycle of 19 years, when 1 was added to the 20th epact, and the cycle was recommenced. Other adjustments are necessary for leap years. The number of any particular year in the cycle is called the Golden Number; and, if 1 be added to the date of the year and the whole be divided by

19, the resulting quotient gives the number of cycles that have elapsed since the beginning of the Christian era, and the remainder will be the golden number of the year, except when the year is the last of the cycle, in which case there is no remainder.

Epaminondas (418-362 B.C.), a Theban hero, born of a noble but poor family. He soon made his mark as a public man, and in 371 he went to Sparta, to represent Thebes upon the question of negotiating a peace with Athens. The Thebans were excluded from the treaty, but he defeated Cleombrotus during the same year at Leuctra. In 369 he was appointed with Pelopidas joint dictator of his country, and the two invaded the Peloponnesus, freed the Messenians, and marched to Sparta, but owing to the generalship of Agesilaus they could do nothing but lay waste the surrounding country and retire. They were both impeached for holding office beyond the prescribed period, but were acquitted. In 368 Epaminondas again invaded the Peloponnesus, and was partially successful, but failed in an attack upon Corinth. He then went to Thessaly to rescue Pelopidas, who had been captured, and in 362, while at the head of a coalition against Athens and Sparta, he was killed while gaining the victory of Mantinea.

Epaulette, a shoulder ornament, consisting of a "scule" and pendant fringe, worn by commissioned officers of the royal navy above the rank of sub-lieutenant, and formerly worn also by officers of the army. The regulations of 1812 gave a pair of epaulettes to officers of higher rank than lieutenant, and to lieutenants a single epaulette, to be worn on the right shoulder; but epaulettes, when worn, are now always worn in pairs. The rank of the wearer is shown by the devices on the top of the epaulette. These are, for Admiral of the Fleet, three small stars, crossed batons, and crown; Admiral, three small stars, crossed sword and baton, and crown; Vice-Admiral, two small stars, and crossed baton and sword; Rear-Admiral, one large star, and crossed baton and sword; Commodore of the First Class, anchor, chain-cable, two small stars, and crown; Captain, if of three years' standing, as Commodore, if of less, only one small star, with anchor, cable, and crown; Commander, anchor, cable, and crown; Lieutenant of eight years' seniority, anchor, cable, and star; Lieutenant of under eight years' seniority, anchor and cable. The epaulettes are of gold. The distinctive device for navigating officers is crossed anchors.

Epée, CHARLES MICHEL, ABRE DE (1712-1789), a French philanthropist, born at Versailles. He was first educated for the Church, and then, owing to a difficulty about Jansenism, studied law for a time, returning afterwards to the Church. He invented a system of instruction of the deaf and dumb, and after some successful experiments upon two sisters he inaugurated in 1765 a school for carrying out his method. He gave his means and his best personal efforts to this service, and endeavoured in vain to get the matter admitted as a department of public expenditure. He left writings

upon the deaf and dumb, and upon his own method of instruction.

Epeira. [SPIDER.]

Epernay, a French town, in the department of Marne, and on the river Marne, 20 miles N.E. of Châlons. It is the centre of the champagne district, and it is estimated that about 5,000,000 bottles yearly are stored in its cellars, 80,000 of which come from the Epernay district. The wine cellars are galleries quarried in the tufa of which the soil is formed. There are manufactures of corks, barrels, and other necessities of the wine trade.

Ephemeridæ. [MAY-FLIES.]

Ephesians, anciently used to designate the inhabitants of Ephesus, as in St. Paul's Epistle to the Ephesians. It was also used in more modern times to denote boon companions or "jolly fellows," and is used in this sense in Shakespeare's *Henry IV*.

Ephesus, an ancient city of Lydia in Asia Minor, on the south side and near the mouth of the Caystrus. It was one of the twelve Ionian cities, and, having a good and extensive harbour, was a renowned market of the ancient world. It passed successively into the power of Lydia and of Persia. The temple of Artemis was one of the seven wonders of the world, being of Ionic architecture, 425 feet long, with a breadth of 220 feet, and having 127 pillars, 60 feet in height. This temple was several times destroyed, once in 356 burnt by a vanity-stricken maniac or joker, Herostratus, who hoped thereby to perpetuate his name. St. Paul founded a church here, and we read in the Acts of the Apostles of the riot made by those "who wrought silver shrines for Diana," and how the whole mob cried for three hours, "Great is Diana of the Ephesians!" The site is now occupied by a village of peasants, Ayasuluk, and is near a station on the Ottoman railway. Important excavations by Mr. J. T. Wood have revealed much.

Ephod, a vestment used by Jewish priests, and corresponding somewhat in shape, if not in origin (as some think) with the modern chasuble. The ephod of the High Priest was elaborately ornamented, and bore a breastplate of precious stones, upon which the names of the twelve tribes were engraved. Other priests wore a plain linen ephod.

Ephori (literally, overseers) were magistrates in many Dorian communities, of whom the best known are the Ephori of Sparta. Their origin is not known, but their number at Sparta was five, and their functions were to keep a watch upon the conduct of other magistrates, including the king. They also looked after public morals like the Roman censors. They were elected by the people, and entered upon office in the autumn.

Ephraem Syrus (325-378), a Syrian theologian, born at Nisibis. He preferred an anchorite's life, and, shunning preferment, retired to Edessa, where he eventually entered upon deacon's orders. He wrote much in his native Syriac upon theology and upon morals, and also against heretics. His works have been translated into Greek and Latin,

and published in the 16th century at Rome, Cologne, and Antwerp. Some hymns and homilies have been ascribed to him.

Epiblast is the exterior of the two layers of cells, of which the embryo known as the *gastrula* (q.v.) is composed. From the epiblast the whole of the epidermal structures and the central nervous system are developed.

Epibole. The cells which form the primitive embryonic stage, known as the *blastosphere* (q.v.), are usually different in size at the two ends. The smaller cells form the external layer or epiblast by two different methods. Either they grow round the larger "endoderm" cells—a process known as "epibole"—or the endoderm cells sink towards the centre of the embryo, a process known as "embole."

Epicalyx, a circle of foliar organs below the flower. Sometimes, as in the strawberry, it is close beneath the calyx, its leaves alternating with the sepals, and probably representing stipular appendages to them. In other cases, as in the mallow, some little length of flower-stalk intervenes, and the epicalyx is then probably merely an involucre of small bracts.

Epicarp, the outer layer in true fruits such as the drupe. It may be smooth and polished, so as to shoot moisture, as in the cherry; glaucous, with a waxy bloom, as in the plum; woolly, as in the peach; or leathery, as in the orange; separable, as in these cases; or less so, as in the lemon. The term is often loosely extended to the outer layer of such receptacular structures, or "inferior" fruits, as the apple or cucumber.

Epicharmus (540-450 B.C.), born at Cos, was a Greek philosopher, a follower of the Pythagorean school, who, after practising philosophy at Megara, came to Syracuse, where he became a dramatist, and is said to have written 52 comedies, which are lost, though 40 of their titles are known. His comedies grew either out of the popular farces of Megara [COMEDY] or, perhaps, out of the mimes, to the detached scenes of which he added a mythological plot, and so gave rise to Sicilian, as distinguished from Ionic and Attic, comedy. Fragments of poems, maxims, and discourses remain, and he was admired by both Plato and Cicero.

Epic Poetry is poetry of a narrative kind, and generally dealing with elevated and heroic stories. Examples are the *Iliad* and *Odyssey* of Homer, Milton's *Paradise Lost*, Dante's *Divina Commedia*, Ariosto's *Orlando Furioso*, Tasso's *Girusalemme Liberata*, Spenser's *Fairy Queen*, the German *Nibelungenlied*. Pope's *Rape of the Lock* is an example of the mock-heroic epic, and the German *Reynard the Fox* and Homer's *Battle of the Frogs* are examples of the animal epic. The word is also used as an adjective to denote "fit for epic poetry," as when Tennyson speaks of a Princess "grand, epic, homicidal."

Epictetus (b. 60 A.D.), a Stoic philosopher, born in Phrygia, was a slave in Rome of Epaphroditus, one of Nero's body-guard, who treated him with cruelty. Afterwards freed, he gave discourses

on philosophy, and taught that man is of himself weak, that he should strive after a standard of good and evil, and that philosophy is the messenger of God to lead men back to better things. Although it is not known as a fact, it is not impossible that he may have come in contact with Christian teaching. He was banished by Domitian, and settled in Epirus. Arrian, his pupil, collected his sayings (*Enchiridion*), and there are four books of philosophical maxims. Both these works have been edited, and there is an English translation by Long.

Epicurus (342-270 B.C.), a noted Greek philosopher, was a native of Samos, where he lived till 18. He then came to Athens, where he is said to have attended the lectures of Xenocrates, then head of the Academy, and then went to Colophon, where his father taught and where he gave lessons in grammar. He then taught philosophy at Mitylene and Lampsacus, and he came in 306 to Athens, where he bought a garden and lectured to many pupils. He was simple of nature and abstemious in habits, took no part in public affairs, and bore the infirmities that came upon his later life with great fortitude. He was a general favourite. In his ethical system he taught that pleasure and pain were the chief good and evil respectively to be sought and avoided, and that virtue should be sought as a means to peace of mind, which is the highest happiness. He has been misrepresented to such an extent as to have become proverbial as the embodiment of sensual greed as the "pig satisfied," and Milton speaks of the "Epicurean sty." But however some of his followers may have misinterpreted him, his system is hardly more Epicurean (in the modern sense of the word) than the system which makes the greatest happiness of the greatest number the standard of action is selfish. In his physical system Epicurus was a follower of Democritus and Diagoras, and held the atomic theory, and that sensation is the result of reflection or emanations (*eidola*) given off by matter. His doctrines were mainly popularised by Lucretius.

Epicycle, in the older systems of astronomy, was an arrangement for representing the motions of the heavenly bodies. The sun, moon, and planets were first conceived to revolve round the earth in circles (the perfect figure); when this assumption failed to explain the phenomena it was assumed that they moved in circles the centre of which revolved round the earth (epicycles, or "circles upon circles"). Further epicycles on these second circles were added with the progress of observation, till the whole complicated scheme was swept away by Kepler (q.v.).

Epicycloid, in *Geometry*, is the curve traced out by a point on the circumference of a circle that rolls round another. If the fixed circle becomes greater and greater, so as to approximate to a straight line, the epicycloid approximates to the *cycloid* (q.v.). If the rolling circle move on the concave side of the fixed curve it generates the *hypocycloid*. If the two are of equal magnitude, the point on the rolling circle just describes one

closed curve in one revolution; this curve is the *cardioid*. Of hypocycloids may be mentioned the *four-cusp*, formed when the rolling circle is one-quarter the diameter of the fixed circle. This curve is the envelope of a line of fixed length moving so that its extremities are kept in two lines at right angles to each other. If the inner circle is one-half the diameter of the outer, the special hypocycloid obtained is the straight line. Such curves were once important in astronomy. [EPICYCLE.]

Epidaurus, a town and seaport of ancient Argolis in the Peloponnesus, celebrated for its temple of *Æsculapius*, which was on a height near the town, and according to an inscription upon it was "open only to pure souls." Yearly numbers of sick people made pilgrimages to it in search of miraculous cures.

Epidemic (from two Greek words *epi*, upon, and *demos*, a people), a term applied to a disease which attacks whole communities and is capable of spreading so as to involve, it may be, the inhabitants of countries widely separated from one another; for example, the Asiatic plague, the Black Death of the 14th century, cholera, and epidemic influenza are all instances of epidemic diseases. It was at one time the fashion to ascribe epidemics to atmospheric influence, and it was customary to use the term "epidemic constitution" to indicate the peculiar conditions of climate and of the atmosphere, which were supposed to determine the invasion of communities by particular epidemic diseases. The doctrine of the germ theory of disease has considerably modified these older views. The reason why the spread of certain diseases is so much greater at some times than at others remains, however, in great part unexplained.

Epidermis (Gk. *derma*, skin), the outer covering of the skin. The skin consists of two parts, the corium or true skin, which is raised externally forming a number of prominences called papillæ, and the epidermis or cuticle, which is superimposed upon the corium, and is accurately moulded over the papillæ, between the depressions of which it dips. The epidermis is composed of layers of epithelial cells. [EPITHELIUM.] These cells are usually described as being arranged in four layers; commencing from within, the first layer, that lying next the corium, is the *stratum Malpighii*, which is composed of spindle-shaped or rounded cells; it is this layer which fills up the depressions between the papillæ; proceeding outwards the next layer is known as the *stratum granulosum*, and consists of a single layer of flattened cells, containing a number of granules. External to this is the *stratum lucidum*, so called from its cells presenting a clear, bright appearance, while most external of all is the *stratum corneum*, which consists of a large number of layers of much-flattened cells. The nucleus, which is a prominent feature in the cells of the deeper layers, becomes gradually lost on proceeding towards the surface, and is completely absent in the most superficial cells of the *stratum corneum*; these last, in fact, consist of mere degenerate scales, and can scarcely

be termed cells at all. The outer layers of the *stratum corneum* are continually being rubbed off, and are replaced by the cells from below; these as they approach the surface become more and more flattened and degenerate. The thickness of the epidermis varies much in different parts of the body; it is thickest in the palms of the hands and soles of the feet. In negroes pigment granules are dispersed throughout the *stratum Malpighii*, and these give rise to the coloured skin of the dark races of mankind. In *Botany* the term is applied to the outer system of cells in most plants serving as a protection and checking excessively rapid transpiration. In some algae and mosses a rudimentary or indistinctly differentiated epidermis occurs; but in higher plants this layer is formed from a primitive merismatic dermatogen. Some of the cells of the epidermis, both on roots and on aerial structures, are often elongated into hairs, which may become divided into several cells, and the walls of which are commonly unthickened. The outer cell-walls of the rest of the epidermis of aerial organs generally form the continuous structureless membrane known as cuticle (q.v.); but the epidermis of the root, requiring to admit moisture rather than to retain it, is generally not cuticularised. The cells of the epidermis commonly contain air or water, with little or no chlorophyll, and can be peeled off as a colourless membrane. In some evergreen leaves there are two or three layers of epidermis. On the stems of perennial plants the epidermis is generally split and thrown off at the end of the first season by the development of cork (q.v.) beneath it, so that smooth green shoots become brown and finely furrowed; but mistletoe (q.v.) retains its epidermis by its remaining merismatic, and in roses and willows the epidermis itself becomes the phellogen or cork-cambium, and gives rise to cork externally. Most surfaces of epidermis in contact with the air are interrupted by openings for transpiration known as stomates (q.v.), which are surrounded by two or more guard-cells that retain both protoplasm and chlorophyll. Submerged structures and roots have no stomates, for which reason the epidermis of the latter was at one time distinguished as "epithelium."

Epigenesis, the biological truth that the development of organisms is the progressive differentiation of a primarily homogeneous germ. This truth, propounded by Aristotle in his work on the generation of animals, was defended by Harvey in his *Exercitationes*, published in 1651, on the evidence of his observations on the incubation of the hen's egg. He says in effect that the formation of the new organism is not the sudden and simultaneous accretion of rudiments of all the organs of the adult, nor the sudden metamorphosis of formative substance into a miniature of the whole organism, but an epigenesis or successive development of the parts from the originally homogeneous rudiment. This view, disputed by Malpighi, Leibnitz, Bonnet, and Haller, was finally established by Caspar Frederick Wolff in his *Theoria Generationis* (1759).

Epiglottis (from two Greek words signifying, upon the tongue), the structure which lies upon

the root of the tongue, and which in the act of swallowing becomes superimposed upon the aperture of the larynx in such a way as to prevent the entrance of the bolus of food into the air tubes, and to direct it downwards into the gullet. The epiglottis consists of a framework of elastic cartilage, covered on its upper and lower surfaces with epithelium. [LABYRX.]

Epigram once denoted, as its etymology *epi* (upon) and *gramma* (writing) shows, an inscription, and then it came to mean a poetical inscription upon a temple, and then came to denote a short poem, sometimes satirical, but always of a witty nature, and often ending in a surprise. Such are the epigrams of Martial and Catullus. It has been said that an epigram should be like a bee:—

"The body should always be little and sweet,
And a sting should be left in its tail."

A well-known example of epigram, adapted from Martial, is that running:—

"I do not like thee, Dr. Fell,
The reason why I cannot tell;
But this alone I know full well,
I do not like thee, Dr. Fell."

Epigynous, "upon the ovary," a term applied to the petals and stamens when they are so carried up by receptacular growth adherent to the ovary as to appear to spring from the top of it. The ovary in these cases is inferior; the calyx, superior. Epigynous insertion occurs in the *Umbelliferae* (q.v.) and some other *Calyciflorae* (q.v.), and gives the name *Epigynæ* to series of *Gamopetalæ* (q.v.), *Incompletæ* (q.v.), and *Petaloid Monocotyledons* (q.v.).

Epilepsy is a disease of the nervous system, in which occur, at irregular intervals, attacks of mental disturbance, which are usually characterised by loss of consciousness followed by tonic and clonic convulsions. The epileptic seizure presents widely varying characters in different patients; it must suffice to describe the phenomena of what may be considered a typical fit. The attack is usually immediately preceded by some warning, whether it be a sense of oppression in the region of the stomach, some peculiar sensation in one or other part of the body, or some imagined impression affecting the organs of special sense. This warning, the *epileptic aura*, as it is sometimes called, is immediately succeeded by the actual fit. The patient often cries out, falls down with much violence, and loses consciousness, the muscles become affected by tonic spasm, and respiration ceases. These phenomena last a few seconds only, and are succeeded by a stage of clonic convulsion. The muscular contractions of this stage may affect one side of the body only, and tongue-biting often occurs. The countenance of the patient is usually livid from obstruction to the natural muscular movements of respiration. After from one to two minutes this stage ceases, the convulsive movements no longer continue, and the lividity passes away, but the loss of consciousness still continues for awhile; the patient usually "comes to himself" quite gradually, and it may be some hours

before recovery is complete. A fit such as has been described is a severe one (*haut-mal*); all degrees between this and the mildest forms (*petit-mal*) are met with. In the very slight cases the attack may be so ill-marked as to quite obscure the real nature of the disease; for example, it may be a mere temporary seizure of giddiness, in which perhaps the patient does not fall down and in which no convulsion occurs. Such attacks are sometimes followed by grave mental disturbance, during the existence of which the patient may perform all kinds of unaccountable actions. In instances of this kind the true nature of the malady is sometimes quite overlooked, the attacks of giddiness being described as fainting fits, while the consecutive mental disturbance is sometimes the cause of much trouble and misapprehension. In some cases one fit has barely passed away before another occurs, and when the number of seizures is considerable the condition is said to be one of *status epilepticus*. The causation of the disease is obscure. It is oftentimes hereditary, and is also associated with the family history of other forms of nervous affection (insanity, hysteria, chorea). The first attack usually occurs between the ages of ten and twenty, and very rarely after forty years of age. The interval between the attacks is of very varying duration; it may be only a few hours, more often a few weeks; in some instances one seizure may succeed another only after an interval of years. Between the attacks the patient may be "quite himself"; in the more established disease, and particularly where fits occur at short intervals, there is usually permanent mental disorganisation, which may amount to actual insanity. The diagnosis of epilepsy is often a matter of some difficulty. It is particularly hard to distinguish in some instances between epileptic and hysterical attacks, and, moreover, the two are often found in association with one another. True epilepsy, however, is independent of the surroundings of the patient, and of the fact of the presence of sympathising onlookers. It occurs quite as frequently, often more frequently, by night than by day. The severer fits are often accompanied by considerable bruising and by tongue-biting (both rare occurrences in hysteria); and the history of the case, and an inquiry into the family history, often throws light on the matter.

Treatment. During a fit the patient should be carefully watched to prevent any injury occurring during the initial stage, and his clothes should be loosened so that there may be no hindrance to respiration. Various drugs are administered to the subjects of epilepsy. Bromide of potassium may be particularly alluded to; in some cases its use is attended with considerable benefit.

Epilobium, a genus of *Onagraceæ*, comprising some 50 species of perennial herbs and undershrubs native to the colder regions of both hemispheres. Their narrow tapering leaves have gained them the name willow-herb. The flower is generally pink or red, but less commonly white or yellow. It has four petals, eight stamens, and an elongated four-chambered inferior ovary, containing

numerous seeds, each having a tuft of long hairs. Of some twelve British species several are inconspicuous, but *E. hirsutum* is known as "Coddins-and-cream," from the peculiar scent of its leaves and shoots, and the long, erect racemes of *E. angustifolium*, the Rose Bay, are still more conspicuous, so that it is commonly cultivated.

Epilogue (Gk. *epi*, upon, *logos*, discourse), an address given to the audience at the end of a play. Many of Shakespeare's plays have epilogues, as have also many of the comedies produced in the last century.

Epimenides, a half mythical poet or philosopher of ancient Greece, who was born in Crete and lived at Gnosus. He was looked on as a prophet and almost divine, and was once summoned to Athens as the fittest man to reconsecrate a temple that had been polluted. For this service he refused all reward, but begged for the friendship of Athens on behalf of Gnosus. A legend represented him as having slept in a cavern for fifty-seven years, and found all around him altered when he awoke—a legend which is familiar to most of us in its modern form of *Rip Van Winkle* as told by Washington Irving, and to some as the subject of Goethe's poem, *The Waking of Epimenides*.

Epinal, a town of France, in a valley of the Moselle, and capital of the department of Vosges, 190 miles S.E. of Paris. It is partly on the right bank of the river, and partly upon an island in it, and has a suburb on the left bank. It is well-built, and has good quays, a Gothic church, a college, a museum, a public library of 20,000 volumes, and a ruined castle on a height. There are manufactures of iron and brass goods and cutlery, earthenware, leather, oil, and chemicals.

Epioria. [ÆPYORINIA.]

Epipetalous (upon the petals), a term applied to the stamens in many gamopetalous flowers, such as primrose and lilac, when an intercalated receptacular outgrowth forms a common tube below both the true corolla-tube and limb and the anthers, so that the latter appear to spring in a more or less sessile manner from the corolla-tube. The same structure is termed *Epiphylous* among petaloid monocotyledons, such as *Narcissus*, and other cases where the perianth is not readily distinguishable into calyx and corolla, as in *Daphne*.

Epiphanius, St. (310-402). Bishop of Constantia, born of a Jewish family in Palestine. Having a taste for solitary life, he retired to a monastery which he founded near his native town. In 367 he became Bishop of Constantia in Cyprus. He was a good theologian and linguist, and a great hater of heretics, especially Arius and Origen. He travelled much. His *Panarion* gives the history of many heresies and their refutation, and he wrote a treatise upon Jewish weights and measures. His feast-day is the 12th of May.

Epiphany (Greek *epiphaino*, to shew forth), the name given to the celebration upon the 6th of January of the making known of Christ to the Gentiles. This festival is also known as Twelfth Day,

and the Feast of the Three Kings. In a wider sense, the word is used to denote any divine appearance.

Epiphytes, plants which grow attached to others without being in any way parasitic upon, or deriving any nourishment from them. They are most numerous in the moisture-laden climate of equatorial forests, having commonly aerial roots, by which they absorb atmospheric moisture. Many ferns, such as the elk's-horn (*Platyserium*), orchids and Tillandsias live in this way. The ivy (q.v.) and some Tropæolums approximate to the habit, living for some time after connection with the ground has been severed.

Epiphytic Orchids, a large proportion of the tropical members of the order which live as epiphytes (q.v.). Their aerial roots are often green, and are sometimes furnished with a special spongy external absorbent layer, or *velamen*. Their branches are commonly thickened into ovoid green "pseudo-bulbs."

Epipodia, the wing-like expansions of the foot of some Mollusca; they are typically developed in the Pteropods (q.v.).

Epirus anciently comprised north-western Greece, but now signifies the southern part of Albania, and is the province bordering upon Greece. There are mountains running in a north and south direction, traversed by valleys, and the district generally is wild, mountainous, and infested with brigands. In the plain of Janina the oracle of Dodona is thought to have been situated, but the oaks and fountain are not to be traced. It is probable that the gloomy mystery of the region gave the idea of Acheron, Cocytus, and Avernus. The people were probably of Pelasgic origin afterwards mingled with Greek settlers. Of the 14 tribes with separate kings, the Molossi became supreme, and their king became king of Epirus. Pyrrhus was perhaps the most notable of these kings. When freed from the Macedonian yoke the country gave Rome much trouble, and Paulus Æmilius treated it severely, destroying 70 towns, and sending 150,000 people into slavery. It was at a later period subdued by the Turks, but in the 13th century it became again autonomous for two centuries under what were called the Despots of Albania. The last of these was George (Scanderbeg), at whose death in 1467 the land again fell into the power of the Turks.

Episcopius, SIMON (Hollandish-Biscop, 1583-1643), a Netherlandish theologian, born at Amsterdam. He graduated at Leyden in 1606, and studied under Arminius and his opponent Gomarus, finally taking the side of Arminius. In 1610 he became pastor of a village near Rotterdam, and pleaded the cause of the Arminians in a conference at the Hague. His appointment as Professor of Theology at Leyden gave great offence to the Calvinists, and he and his adherents were condemned at the Synod of Dort. For a time Episcopius retired to Rouen, where he wrote on behalf of Arminianism, and also had a controversy with a Jesuit. In 1626 he returned to Holland, and died Rector of the Arminian College at Amsterdam. Among his works are his

Confessio (1622), *Apologia pro Confessione* (1629), and *Institutiones Theologicae*, written after his return to Holland, and left unfinished at his death.

Epistaxis (from the Greek, to drop or let fall), bleeding from the nose. Epistaxis may occur as the result of injury, and is caused in rare instances by growths affecting the back of the nose or pharynx. It not uncommonly occurs spontaneously, particularly in young adults and in persons of middle age. The treatment of epistaxis consists in enforcing absolute rest and applying cold. Elevation of the arms is a useful expedient in mild cases. In some instances, when the flow is excessive, much more extreme measures must be adopted, such as plugging the *narces*. For the performance of this operation, however, skilled assistance would have to be obtained.

Epistolæ Obscurorum Virorum ("Letters of insignificant men"), a title given to some burlesque and witty, though often indecent letters published at Cologne in the 16th century, and having for their object the bringing into contempt the literary doctrines and methods of the schoolmen and monks. These letters emanated from the knot of scholars of the revival of learning, and have been variously attributed to Reuchlin, to Erasmus, and to Ulrich von Hutten. The last of the three did write a second part in 1517, but the first part appeared in 1516, and is said to have been the work of Crotus Rubianus. The letters had some influence in bringing about the Reformation, and were placed upon the *Index*. There is an edition with commentary (1889).

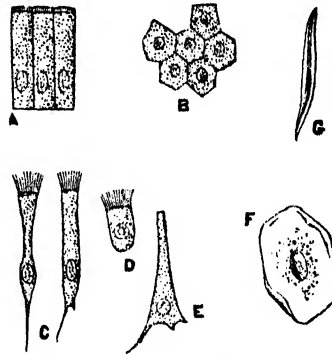
Epitaph (*epi*, upon, *taphos*, tomb), originally meant either an address delivered at a tomb, or an inscription upon it, which latter meaning is the only one borne by the word at the present day. The Egyptian epitaph consisted of the name and condition of the dead with perhaps a prayer, but the Greek epitaph was of a poetical and elaborate character. The Roman epitaph was simple, and, as tombs were often by the wayside, "*Siste viator*" was a common one. The 18th century in England was an age of tedious and exaggerated epitaphs, of which there are examples in Westminster Abbey and in many churches and cathedrals. A noble epitaph is the well-known one to Sir Christopher Wren in St. Paul's: "*Si monumentum requiris, circumspice*." Shakespeare's epitaph is also well known. There are endless examples of quaint, comic, and eccentric epitaphs to be found in our country churchyards. Some are elaborate allusions to the calling or trade of the dead they commemorate, as, for instance, those of Benjamin Franklin, of a blacksmith in Sutton churchyard, Surrey, and of the pie-woman. Some witty epitaphs have been written—*e.g.* Piron's, composed by himself—

"Ci-git Piron, qui ne fut rien,
Pas même Académicien."

Epithalamium (Gk. *thalamos*, chamber), an ode composed and sung outside a bridal chamber upon a wedding-night by young men and maidens, the companions of the newly-wedded pair. Sappho,

Pindar, Theocritus, Catullus, and Spenser have all made notable compositions in this kind of poetry. Shakespeare often makes use of the word, and Burnet speaks of one of the Psalms as an epithalamium to Christ and His Church.

Epithelium. The skin and the various mucous membranes of the body are covered with an investment of cells known as *epithelial cells*. These cells are of various shapes. They may be *columnar*, a single layer of such cells lining the mucous membrane of the alimentary canal from the cardiac end

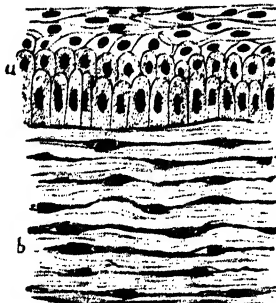


VARIOUS KINDS OF EPITHELIAL CELLS.

A, Columnar cells of intestine; B, Polyhedral cells of liver; C, Ciliated cells of trachea; D, Ciliated cells of frog's mouth; E, Inverted conical cell of trachea; F, Squamous cell of mouth; a, Squamous cell seen edgewise.

of the stomach downwards, and also occurring in the tubules of the kidney, the small bronchi, and in many glands. They may be squamous or flattened, as in the superficial layers of the epithelium of the skin [EPIDERMIS]; or they may be conical, fusiform, or polyhedral. A simple epithelium is one in which only a single layer of cells is present. In the stratified forms there are several layers one superimposed upon the other. Thus excellent examples of stratified squamous epithelia (pavement epithelia) are met with in the epidermis, in the tongue cavity of the mouth, pharynx, œsophagus, and on the surface of the cornea, while stratified columnar epithelium is met with in the mucous membrane of the larynx, trachea, and large bronchi. The situations in which simple columnar epithelium occurs have already been detailed. A single layer of flattened cells, simple squamous epithelium (*endothelium*, as it is often called), is met with on the surface of serous membranes, and in the lining walls of blood-vessels. An epithelial cell consists of a nucleated mass of protoplasm, and the individual cells are in close apposition one with another, being merely separated by an insignificant amount of intercellular substance (interstitial cement substance). Ciliated cells present on their free surface a fringe of very fine hair-like processes termed cilia; these processes in the living cell are in rapid movement, as can be well seen, for example, in a scraping from the roof of the mouth of a frog (D in figure); the movement

produces an appearance such as is seen when the wind sweeps over a field of corn. In the human subject ciliated cells occur in the trachea and in other parts, but are not nearly so widely distributed



STRATIFIED EPITHELIUM OF THE CORNEA.

as in some of the lower animals. Two other varieties of epithelial cells may be mentioned: *goblet* or *calice cells*, which are met with in mucous glands, and in the mucous membrane of the respiratory and alimentary tracts; and the *prickle cells* which are found in the deeper layers of the *stratified pavement* epithelium of the skin. Some epithelial cells are filled with black pigment granules (choroid and iris, and in the skin of negroes).

Epizoa, a subdivision of the Crustacea once accepted for the three sessile and degraded orders, the Cirripedia, Ichthyophthira, and Rhizocephala. The group is, however, now abandoned, and included in the sub-class Entomostraca (q.v.), as the Rhizocephala are regarded as degraded Cirripedia and the Ichthyophthira as parasitic Copepods.

Epoch of a planet at any instant is its mean longitude reckoned from the sun. It is one of the elements in a planet's orbit. In *kinematics*, the epoch of a simple harmonic motion (q.v.) denotes the position of the moving body, measured from its extreme or mid-point, from which time is reckoned.

Epping, a village of Essex, 17 miles from London, on the border of Epping Forest. Pop. (1901), 3,789.

Epping Forest, some 5,500 acres of forest-land in the south-east of Essex, is the remnant of the royal Forest of Essex, which before the reign of John extended over almost all the county, and which was then limited to the Forest of Waltham, some 60,000 acres. Before the Reformation, subject to the sporting rights of the Crown, this was mainly vested in the abbots of Waltham and Barking; but there was also a right to pasturage, pannage of pigs, and lopping of trees for fuel, belonging to the commoners. Hainault Forest, east of the river Roding, having been grubbed up in 1851, and extensive encroachments having taken place, the remainder was between 1865 and 1870 in danger of destruction, the lords of the manors having compounded separately with their commoners. The Corporation of London, happening to hold rights of common in

virtue of a cemetery at Wanstead, successfully maintained the right of "intercommonage" over the whole forest. In 1878 an Act was passed by which it was "disafforested"—(i.e. ceased to be royal)—the Corporation becoming conservators, purchasing the manorial and lopping rights, and maintaining the forest "as an open space for recreation and enjoyment." The forest consists of extensive woods of pollard hornbeam, several groves of fine beeches, with a good deal of holly undergrowth and occasional large crab-apple trees, wide patches of heather and birch, and bordering grass-lands. Oaks are not very numerous. The Act provides that "the natural aspect of the forest" is to be maintained, and it has long been the favourite hunting-ground of the London entomologists and fungus-hunters, besides affording a playground for countless school treats, volunteer corps, cricket clubs, and devotees of golf. Birds of many kinds are increasing in the forest; the ancient dark breed of fallow-deer have multiplied considerably; and the roe-deer and the badger have been successfully reestablished. In the heart of the forest are two pre-Roman camps. At Chingford is a fine Tudor half-timbered building known as Queen Elizabeth's Lodge. In 1882 Queen Victoria declared the forest to be open for ever as a recreation ground.

Epsom, a town of Surrey, 15 miles S.W. of London, once renowned for its mineral springs (whose salts gave their name to a valuable mineral salt now obtained elsewhere), and still renowned for its races, the chief of which are the "Derby" and the "Oaks," in early summer, and which for a long time past have been the carnival of London, and have provided material for the painter, the novelist, and the student of national character. [DERBY DAY.] Pop. (1901), 10,915.

Epsom Salts consist of hydrated sulphate of magnesium $MgSO_4 + 7OH_2$. It is found naturally in sea water and in many saline springs, and as the mineral epsomite. A sulphate *kieserite* containing less water ($MgSO_4 + OH_2$) occurs largely in the salt beds at Stassfurt. Epsom salts are prepared from all these sources. It is obtained from sea water by further evaporation of the *bittern* (q.v.). It is also obtained from the crude Stassfurt *kieserite*, and by treating *dolomite* or magnesian limestone with sulphuric acid. It crystallises in rhombic prisms, very soluble in water and possessing a bitter taste. If heated, six of the water molecules are driven off at 153° , but the remaining molecule is not evolved until a higher temperature, 200° , is reached. It is largely employed in the chemical laboratory, and is the chief source of other magnesium compounds. It is much used in dyeing, and employed in medicine as a purgative.

Equations. 1. In pure and applied mathematics, are expressions representing the equality of two or more entities. For convenience these entities are expressed symbolically by letters or other such signs. Very little has been done with any but algebraic equations—i.e. those dealing with number. In quaternions the equality of entities involves more than equality of their magnitude, for direction and sense of the vectors (q.v.) are included in the

symbols adopted. Also in symbolic logic, the equality of many properties or attributes of the symbolised entities may be involved by the equation. These latter are examples in what are called non-commutative algebras, which are not yet studied by mathematicians so fully as their importance deserves.

Ordinary algebraic equations are meant to exhibit identities. Some of the identities may be proved by ordinary processes to be true whatever be the values of the symbols employed. Thus

$$(a + b)^2 = a^2 + 2ab + b^2$$

tells of the identity of the two expressions separated by the sign of equality =. The equation is true whatever be the values of a and b ; it is called an *identical equation*, or *identity*. On the other hand, an equation may not be true unless certain symbols represent certain determinate numbers. Thus $a^2 = 3a$ is only true when $a = 3$ or $a = 0$. Such equations are *conditional*, and it is one of the most important processes in algebra to discover the conditional values upon which the identity of the equation depends. These values are called the *solutions* or *roots*.

A single equation containing one unknown quantity is sufficient to determine that unknown. If this only occurs in the *first degree*—i.e. multiplied by some known number and not by itself—we have a *simple equation*, which admits of but one answer. That is to say, only one value of the unknown will make the equation true. If of the second degree, the unknown occurring as a square, the equation is *quadratic*, and there are two solutions, as in the example of $a^2 = 3a$ above quoted. An equation of the third degree is a *cubic*, and has three solutions; and so on for higher degrees. There are general methods for the solution of equations of the first four degrees; various special cases of quintics (of the fifth degree) may be solved, but it is shown that no general solution can be given for them.

If an equation contains two unknowns, x and y , it is insufficient to give both their values, and a second equation connecting them is necessary. Such a pair of equations are termed *simultaneous*. Three are necessary to determine three unknowns, four for four unknowns, and so on.

Equations in astronomy generally mean corrections to observations. Thus in the article DAY it is stated that the solar days throughout the year are not actually of constant length, and that for convenience an average length was chosen, and called a mean solar day. A clock records mean time, but a sundial records *apparent* or solar time. The term *equation of time* is used to denote that which must be added to or subtracted from the apparent time at any instant to give the mean time. The two only coincide four times during the year.

Equation to the centre of a planet means a correction necessary to apply to the motion of a planet when assumed to travel in a circle round the sun as centre.

Personal equation means a correction to be applied to an observation on account of defect in the observer. Thus a measurable though small interval

of time exists between an event and the observer's most rapid notification of the event. This interval is his *personal equation of time*; it varies in different persons and somewhat for different senses, being different if the event is a flash of light, a sharp sound, or a sudden contact with the observer.

2. Equations, in *Chemistry*, serve to express the interactions which take place between different compounds, the formulæ of the reacting bodies being placed on the left hand side of the equation, those of the products on the right, e.g. $2\text{KOH} + \text{H}_2\text{SO}_4 = \text{K}_2\text{SO}_4 + 2\text{OH}_2$. [CHEMISTRY.] By a slight extension of the equation the heat evolved or absorbed by the reaction may be also indicated. Thus the equation $\text{PbO} + \text{H}_2\text{SO}_4, \text{Aq} = \text{PbSO}_4 + \text{Aq} = 142,200 \text{ cal.}$ states that when 223 grams of oxide of lead are dissolved in dilute sulphuric acid 303 grams of solid lead sulphate are formed with the evolution of 142,200 units of heat (caloric = quantity of heat required to heat 1 gram of water through 1°C.). In this the notation frequently used now is employed, i.e. the use of thick type to indicate solids, ordinary type for liquids, while gases would be indicated by italics. Aq indicates an indefinite but comparatively large quantity of water.

Equator is the great circle on the surface of the earth, equidistant from the poles. It is the greatest circle that can be drawn on the earth, and is 24,899 miles in circumference. The celestial equator is the great circle in the celestial sphere midway between the poles; it represents the intersection of the plane of the terrestrial equator with the celestial sphere.

Equatorial, in *Astronomy*, is a telescope designed and arranged for special observations. The telescope itself is capable of rotating at right angles about one axis, and this again may be rotated about a second at right angles to the first. The first is called the *declination axis*, and the second the *polar*; the latter is fixed in position so as to point to the poles. Rotation of the telescope about the declination axis commands a view along a meridian. If clamped to this axis and rotated about the polar axis, it views points on parallels of declination, all these points being at the same distance from the pole. Such a parallel is the path of a star or planet, and if the polar axis is rotated at the proper rate by clockwork, the telescope may be made to "follow" the object viewed. Equatorials are the most convenient in this latter respect, and also for finding objects from the usual data of declination and right ascension. The largest telescopes are therefore built with the equatorial mount, as, for example, the 23-inch Clark telescope at Princeton, the 4-foot Melbourne reflector, and the great 36-inch Lick reflector in California. [TELESCOPE.]

Equestrian Order, THE (Lat. *equus*, horse), formed in early days the cavalry of the Roman army. These were said to have originated with Romulus, who caused each of the three tribes to furnish 100 horsemen. Later their number was increased to 3,600, who might be appointed from

patricians or plebeians, and still later a property qualification admitted to what had become a privileged political order. The horse for a long time, as well as pay for his keep, was provided by the state, and the censors had power to take away a man's horse—i.e. degrade him from the order—for misconduct. By the time of the Gracchi the order had practically ceased to have military importance, and became a capitalist and commercial, but non-noble class. From that period to the reaction under Sulla (except for a short interval) the order exercised the judicial functions till then confined to the Senate, while after 70 B.C. they shared them with the Senate. Under the Empire the order gradually declined in power and importance.

Equidae, a family of Perissodactyle Ungulates containing the Ass and the Horse (both of which see).

Equilibrium. 1. In *Dynamics*, a condition of balance among the set of forces acting on a body, such that there is no resultant tendency to change its state of rest or motion. The forces acting on a book lying on a table, which include the various pressures of its different particles downwards on the table, and the upward supporting forces of the table, are in equilibrium and the book does not change its state of rest. Also a train pulled along by a locomotive at its maximum rate of motion is acted on by the tractive forces of the engine and by various resistances of the rails, air, etc. These forces are in equilibrium, and the train does not change its state of uniform motion. Thus equilibrium of the forces acting on a body, and the state of rest of the latter, must not be confused with each other. The study of forces in equilibrium is known as *Statics*.

2. In *Chemistry*. When a chemical system arrives at a state in which no further change occurs, a reaction and reverse reaction taking place at equal rates, the system is said to be in chemical equilibrium. Thus if sulphuric acid be added to a solution of sodium nitrate a reaction will take place, represented by



resulting in the formation of nitric acid and sodium sulphate. These products, however, by their interaction can give rise again to sulphuric acid and sodium nitrate. When the proportions of these acids and salts reach a certain value the two reactions proceed at exactly equal rates and there is no further change. In all dissociation (q.v.) phenomena also, for every temperature there is a definite pressure of the dissociated gases at which equilibrium occurs, the products recombining at the same rate as the body dissociates. The subject of chemical equilibrium has within late years been approached with great success from the mathematical standpoint.

Equinox, in *Astronomy*, is the time when the sun apparently crosses the plane of the equator. It is sometimes understood as the *equinoctial point*, or point where this crossing is effected. It occurs twice a year—on the 21st of March and the 22nd of September; the first is called the *vernal equinox*,

and the second the *autumnal*. At these times, the sun being directly over the equator, the days and nights are of equal length; at the vernal equinox the days are becoming longer than the nights, and at the autumnal equinox the days are becoming shorter. The vernal equinoctial point is known as the *first point in Aries*, and is important in star measurements. The line joining the two equinoctial points is called the line of the equinoxes, and the fact of the gradual change in position of this line is of much importance in astronomy. The earth's axis remains at a constant angle to the plane of the sun's apparent motion, but does not remain constant in direction. Just as a spinning-top may wobble, with its mass-centre motionless and the extremities of its axis describing circles, so that this axis is for some time at the same angle to the ground, so the earth's axis wobbles at a constant angle to the plane of the ecliptic. This affects the line of the equinoxes, and causes it to slowly travel round; hence the term *precession of the equinoxes* in describing this irregularity of the earth's motion. The lengths of summer and winter depend on the position of the equinoctial points. If we divide the year into two parts, calling that portion summer between vernal and autumnal equinoxes, and the rest of the year winter, we may say that our winter in the northern hemisphere is eight days shorter than summer. But with a different position of the line of equinoxes an extreme winter thirty-three days longer than the corresponding summer may occur, or an extreme summer thirty-three days longer than the corresponding winter. Such extremes are 10,500 years apart, but they represent widely different conditions of climate; the first extreme gives us a glacial epoch and the second a genial epoch. Our present condition is intermediate, in the northern hemisphere tending to a genial epoch but in the southern tending to a glacial epoch. [EARTH, PRECESSION, NUTATION.]

Equisetum, the only existing genus of the order Equisetaceæ and the class Equisetinae of the Pteridophyta (q.v.), comprising some twenty-five species, found in most parts of the world, except Australasia. They are isosporous, like most ferns; but the spores have three coats, of which the outermost is spirally split into four hygroscopic elaters (q.v.), which uncoil in dry air, and serve to link the spores together when dispersed. On germination they produce diocious prothallia, those least nourished being smaller and bearing antheridia. The antherozoid is comparatively large, twice or thrice coiled, and dilated posteriorly. The female prothallus, like a curly endive leaf half an inch long, bears archegonia like those of ferns. The sporophyte consists of a creeping rhizome sending up erect branches that are generally annual. These are articulated and strongly fluted, each ridge ending at the node above in one leaf-sheath of a ring, which lie in the grooves of the next internode. The internodes are hollow, the nodes solid; there is a fibro-vascular bundle in each ridge with a central (carinal) air-cavity, and sometimes other (vallecular) air-passages in the cortical tissue one below each furrow. In the furrows of the stems are

numerous stomata. In some species the "fructification" terminates a short special unbranched branch which, having no chlorophyll, is brown; in others it terminates a green branch which bears whorls of branches at each node. It consists of a cone made up of whorls of sporophylls each of which is a pettate sorus bearing from six to nine sporangia round its margin. All the cell-walls of the plant are strongly impregnated with silica, amounting to more than half the ash of the plant, so that large quantities of *E. hyemale* are imported as "Dutch rushes," and used in bundles for polishing purposes. None of the existing species approach the dimensions of the fossil Equisetinae of Palaeozoic rocks, such as *Calamites*, *Annularia*, and *Asterophyllites*. These all differ apparently from our Equisetaceae in producing spores of two kinds (megaspores and microspores), being, that is, "heterosporous."

Equisant (meaning astride like the legs of an equestrian) is a term applied to the folding of leaves in the bud when each is folded longitudinally down its midrib, like the two halves of a sheet of note-paper, and the edges of one overlap both edges of another and younger leaf, as if astride of them. The leaves of *Iris* are folded in this way. When, as in the sepals of the poppies, the edges of one leaf are astride of one edge of another it is termed *half-equisant*.

Equity, a species of unwritten law, so termed by way of distinction from the original and proper law of England or (as it is usually termed) the Common Law. The origin of equity may be thus stated:—The ancient structure of our national jurisprudence, whatever its other merits, was very defective in compass and enlargement of view. It paid no attention to several matters which it is incumbent on a civilised judicature to deal with, and to others it applied maxims too strict to satisfy the idea of justice in an advanced state of society. Its judicial remedies were also cumbersome and limited in character. Thus (to quote from Mr. Justice Story's *Treatise on Equity*), a Court of Equity has jurisdiction in cases where a plain, adequate, and complete remedy cannot be had at common law. The remedy must be plain, for if it be doubtful and obscure at law, equity will assert a jurisdiction. It must be adequate, for if at law it falls short of what the party is entitled to, that founds a jurisdiction in equity; and it must be complete, that is, it must attain the full end and justice of the case; it must reach the whole mischief, and secure the whole right of the party present and future—otherwise equity will interpose and give relief. The jurisdiction of a Court of Equity is sometimes concurrent with the jurisdiction of the courts of law, sometimes assistant to it, and sometimes exclusive. It exercises concurrent jurisdiction where the rights are purely of a legal nature, but where other and more efficient aid is required than a court of law can afford. In some of these cases courts of law formerly refused all redress, but now will grant it. For, strict law comprehending established rules, and the jurisdiction of equity being called into action when the

purposes of justice rendered an exception to those rules necessary, successive exceptions on the same grounds became the foundation of a general principle, and could no longer be considered as a singular interposition. Thus, law and equity are in continual progression, and the former is constantly gaining ground upon the latter. Every new and extraordinary interposition is by length of time converted into an old rule; a great part of what is now strict law was formerly considered as equity, and the equitable decisions of this age will unavoidably be ranked under the strict law of the next (Professor Millar: *View of the English Government*). But the jurisdiction, having been once acquired at a time when there was no such redress at law, is still retained by the courts of equity. The Court of Chancery was the principal court for equitable relief, but now by the amalgamation of the Courts of Justice, the jurisdiction formerly exercised by the Court of Chancery is vested in and exercised by the Chancery division of the Supreme Court. [JUSTICE, COURTS OF.]

Equivalent Weights. The atoms of different elements have a varying power of combination with other elements. [ATOMIC THEORY.] Thus one atom of chlorine can combine with one atom of hydrogen, while one atom of oxygen can combine with two, and an atom of carbon with four hydrogen atoms. This power is known as the *valency* (q.v.) of the atom. Thus chlorine is *monovalent*, oxygen *divalent*, nitrogen *trivalent*, and carbon *tetravalent*. The atomic weight [ATOMIC THEORY] of an element divided by the valency gives what is known as the *equivalent weight*—i.e. the weight which can unite with or is equivalent to the part by weight of hydrogen. This can in most cases be found without any regard to theory, thus 35.4 parts chlorine can unite with 1 of hydrogen, and with 39 of potassium. Hence 39 parts of potassium are equivalent to 1 of hydrogen—i.e. the equivalent weight of potassium is 39. This being the statement of an experimental fact, and not depending upon any theoretical basis, the equivalent weights were for a long time used in preference to the atomic weights, and still are so used by a section of French chemists. Owing, however, to a variable valency many elements possess variable equivalent weights, and by far the majority of chemists have discarded the older system.

Era, a period of time either noted for some special occurrence, or a series of years reckoned from some particular, generally historic, event. Thus we speak of the Christian, the Persian era.

Erard, SÉBASTIEN (1752-1831), a great musical instrument maker, was born in Strasbourg. He went to Paris when eighteen years old, and joined with his brother to make pianofortes, which, by reason of their excellence and superiority to anything of the kind then known, brought the brothers much renown. The Revolution drove him from France, and he set up a factory in London. He invented the double movement for the harp and for the piano, and made other improvements in the former instrument.

Erasmus, DESIDERIUS (1467-1536), a noted Low Country scholar, born at Rotterdam, his father being one Gerard of Gouda, and his mother the daughter of a physician. The pathetic history of his parents has been well set forth by Charles Reade in his novel *The Cloister and the Hearth*. Beginning as a choir-boy of Utrecht cathedral, he afterwards went to school at Deventer, where he made marvellous progress. When he was 14, his parents being dead, he entered a monastery, and, against his inclination, entered the order at 17, soon after, however, going to Paris to complete his studies. He there gave lessons to Englishmen, to Lord Mountjoy among others, and this nobleman gave him a pension. He visited England, and then returned to Paris, and went to Italy, becoming a Doctor of Theology at Bologna. Having received from the Pope a dispensation from his monastic vows he went to Venice, Padua, and Rome, and finally yielding to the wishes of his English friends, he came to that country, being high in favour with Henry VIII., and enjoying the friendship of the greatest men of the time, notably Dean Colet and Sir Thomas More. He lectured on Greek in Oxford for a time, and then travelled in Germany and the Low Countries, and finally went to Basel, where his works were published, and where he died. His tomb still exists in the Calvinist church there. Besides being one of the most learned men of his age, he had great wit, prudence, and knowledge of the world, and his tastes led him to prefer a literary life to the turmoil of controversy or office, and his wisdom made the bigotry of the time hateful to him. His love of truth made him see more than one side of the questions that agitated the time, and exposed him to the charge of indifference. He edited many classics, and an edition of the Greek Testament, besides writings philological and theological. His *Praise of Folly* is well known, and extracts from his *Colloquia* have been used as school texts.

Erasure, the alteration of a deed or document by "shaving" or "scraping" any part of it. When this is done to any material part after execution, the deed is invalidated. In the case of deeds an unexplained alteration is presumed to have been made at or before execution; but this is, of course, open to rebuttal. An immaterial alteration has no effect in avoiding the instrument. As regards wills, alterations therein are disregarded by the Court in granting Probate, unless they are authenticated by the signatures of the testator and witnesses, or unless the fact of their having been made before execution can be proved.

Eratosthenes (born 276 B.C.) was a man of letters in the time of the Ptolemys, being a native of the African city Cyrene. He was librarian at Alexandria, and did much for science. He discovered the obliquity of the ecliptic, made researches concerning the size of the earth, made a system of mathematical geography, and wrote a work on the constellations. Fragments of his geographical works, besides his work on the constellations, have been published.

Erbium, a rare metallic element, atomic weight 166, which occurs with other metals in a few rare minerals. It forms an oxide Er_2O_3 , and its salts resemble closely those of Yttrium and Terbium.

Ercilla y Zuniga, DON ALONSO DE (1533-1596, or thereabouts), a Spanish soldier and poet. When quite young he was brought to the court of Charles V., and became page to the infant Don Philip, whom he accompanied in his travels in Europe, and when he came to England to marry Queen Mary in 1554. He then accompanied an expedition against the revolted Araucanian Indians of Chili, and in the intervals of the fighting, in which he bore his full share, he worked up the incidents of the campaign into an epic poem in octave measure, half poem and half chronicle. The poem is mentioned by Cervantes, and was laid under contribution by Lope de Vega, and has been translated into Italian and into French.

Eckmann-Chatrian, the compound name of two French authors, who collaborated in writing some well-known French novels setting forth chiefly the vicissitudes of Lorraine, of which they were both natives. Émile Eckmann was born in 1822, and followed the profession of the law; he died in 1899; while Alexandre Chatrian was born in 1826, and was by turns a glass-blower, a tutor, and a railway clerk. He died in 1890. Among the best known of their works are *Madame Therèse*, *L'Histoire d'un Conscrit*, *Sirge de Phalsbourg*, *Waterloo*, and *L'Histoire d'un Plébiscite*. *Le Juif Polonais* and *L'Ami Fritz* have been dramatised, and are well known to London audiences, especially the former under its English title of *The Bells*, the most successful piece of Sir Henry Irving.

Erebus, an active volcano in Victoria Land, in the great Southern Ocean. It was discovered by Ross in 1841, and he called it after one of the ships composing the expedition.

Erechtheus, called also ERICHTHONIUS, a mythological character of ancient history. He was a hero of Attica, and introduced into Athens the worship of Athene. The Erechtheum was erected in his honour, and the Athenians were sometimes known as *Erechthidae*.

Erfurt, a Prussian town on the Gera, in Saxony, 13 miles W. of Weimar, and the capital of a government of the same name containing 1,263 square miles. In the 15th and 16th centuries it enjoyed a great degree of freedom, being almost independent, and was a noted commercial centre by reason of its woollen and linen manufactures, and it had a famous university, which was suppressed by Prussia in 1816. It still has manufactures of cotton and woollen goods, leather, shoes, candles, ironmongery, brandy, and liqueurs. In the tower of its Gothic cathedral is a famous bell, which weighs 275 cwt. Luther lived here as a monk, and his cell used to be shown, but it has been burnt along with the house that contained it. The town was bombarded and taken by the Prussians in 1813, and was granted to them by the

Congress of Vienna in 1814. Napoleon, Alexander of Russia, and some of the German sovereigns held a congress here in 1808.

Erg, in *Physics*, the expression used to signify the amount of work done by one dyne (q.v.) acting through one centimetre (q.v.).

Ergot (from the Old French *argot*, a cock's spur) is one stage in the development of *Claviceps purpurea*, a fungus belonging to the order Pyrenomycetes, which attacks the pistils of grasses and sedges, but especially of rye, *Secale cereale*. It gets its common name, and that of *Secale cornutum*, or "spurred rye," used in pharmacy, from its spur-like form. Its ascospores are filiform, and on germinating, produce hyphal germ-tubes at several points. If these come in contact with the ovary of a grass they penetrate it, covering it with a felted, white "hymenium." This bears numerous cylindric "sterigmata," or "basidia," each bearing a spherical "gonidium" or "acrospore" at its apex. A sugary juice or "honey-dew" oozes out of deep furrows in the attacked ovary, carrying with it the gonidia, and is greedily eaten by insects, in which method this slimy stage, formerly described as a distinct genus under the name *Sphacelia*, is propagated. Each gonidium is capable of reproducing the sphacelia. The mycelium at the base of the ovary next forms a more compact mass or "sclerotium," which becomes dark-violet externally and grows into the spur-shaped mass or "ergot," sometimes over an inch in length. This generally rests till the following autumn or spring, and then gives rise to several "stromata," each consisting of a short stalk and a globular head or "capitulum." Sunk in the outer surface of these heads are the numerous flask-shaped cavities or "perithecia," in which are the club-shaped "asci." Each ascus contains several of the filiform ascospores. The preparations of this drug are a liquid extract, infusion, and tincture. It is sometimes administered hypodermically in the form of the *injection ergotini hypodermica*. Ergot possesses the property of stimulating unstriated muscle to contraction, and is employed in checking hemorrhage, and to promote contraction of the uterus. A curious group of symptoms known as "ergotism" sometimes occurs in those who have eaten rye bread contaminated with ergot. In such persons gangrene affecting the extremities is one of the most marked phenomena.

Eric, the name of many kings of Sweden, the last of them being the son of Gustavus Vasa. He succeeded his father in 1560, but his tyranny, and his marriage to a peasant girl, led to a rising headed by his two brothers, John and Charles. Eric was deposed, and died in prison in 1577. His tyrannical habits apart, he seems to have been a patriotic ruler, who did much for law, commerce, art, and religious freedom, and created a new Swedish nobility.

Erica. [HEATH.]

Ericsson, JOHN, engineer, was born on July 31, 1803, at Langbanshyttan, Wermeland, Sweden,

and after having been employed in the survey of the Baltic and North Sea Canal, entered the Swedish army. In 1826 he visited England in order to introduce one of his earliest inventions, the caloric engine. He soon afterwards resigned his commission, and devoted himself entirely to mechanical pursuits. In 1836 he successfully applied the screw propeller for the purposes of navigation, and in 1839 migrated to New York, where he built the *Princeton*, the first steam warship having her machinery below the water-line, and so out of the reach of shot. He exhibited very numerous inventions at the Great Exhibition of 1851. A few years afterwards, during the American Civil War, he built the famous *Monitor*, the first ironclad with revolving turrets and with a minimum of freeboard, and her success at the battle of Hampton Roads, where she drove off the *Merrimac*, made Ericsson's name known to all the world. He subsequently employed his great abilities in perfecting a solar engine, and in designing torpedoes, and submarine guns. He lived in America until his death in 1889, but his body was sent in an American man-of-war to his native country, and there buried with much pomp. His elder brother, Nils (1802-1870), was also a distinguished engineer, and is chiefly remembered for his work in connection with railways and canals.

Erie, a city and port on Presqu'île Bay, on the south shore of Lake Erie, in the state of Pennsylvania, United States, 300 miles N.W. of Pennsylvania, with which it communicates by a railway. The harbour is good, and there is a large trade in coal, iron, petroleum, and farm produce. There are foundries, blast-furnaces, and other iron-works, oil refineries, wood factories, breweries, and tanneries.

Erie, LAKE, one of the great group of North American Lakes, lies between Lake Huron and Lake Ontario. Its direction is N.E. and S.W., between lat. 41° 30' and 42° 50' N., and long. 78° 53' and 83° 25' W., its southern shore being in the United States and its northern in Canada. Lakes Superior, Michigan, Huron, and St. Clair drain into it by way of the Detroit and St. Clair rivers in the S.W. and its own waters flow into Lake Ontario by the Niagara river in the N.E. Of its several islands only one—Point Pele—is inhabited. With an area of 9,600 square miles, it has a length of 265 miles and a breadth of 63 miles in the centre, has an extreme depth of 45 fathoms, is 565 feet above sea-level, and 30 feet below the level of Lake Huron. Its navigation is difficult and dangerous in stormy weather, as readers of Fenimore Cooper's *Pathfinder* will remember. The banks vary in height up to 100 feet, and there is a considerable traffic upon it. The chief harbours are Buffalo, Erie, and Cleveland in the United States, and Port Dover, Port Stanley, and Barwell in Canada.

Erigena, JOHANNES SCOTUS, a scholar and metaphysician of the ninth century who was born in Ireland. He lived chiefly in France, where Charles the Bald placed him at the head of the palace school, and employed him to translate the Greek of the supposed Dionysius the Areopagite

into Latin, and to compose a controversial treatise on *Predestination and Free-will*. This and his *De Dictione Naturæ* were condemned by the Church on the ground of their pantheism. The place and date of his death are unknown. He is ranked as one of the founders of Realism.

Erivan, a fortified town in Transcaucasia, capital of a government of the same name, containing 10,740 square miles, on the left bank of the Sanga, 30 miles N.E. of Mount Ararat. The town is important as being upon the caravan route between Russia and Persia, and it has manufactures of cotton, earthenware, and leather. There is a castle on the top of a hill, upon which part of the town is built, and there are some Armenian churches, mosques, and a bazaar.

Erlangen, a Bavarian town in a plain, 10 miles N.W. of Nürnberg, almost rebuilt in the early part of the 18th century after being almost destroyed by fire. It is square, with streets at right angles, and has seven gates. French refugees settled here in the 17th century, and gave a great impetus to the manufactures, and there are several breweries. It has three important churches, an old castle, a stadtbaus, a theatre, and a university, and there are good gardens and walks in the suburbs.

Erlau, a Hungarian town on the Eger, 65 miles N.E. of Pesth. It is the see of an archbishop, and has a cathedral, an archbishop's palace, a ruined castle, a monastery, a courthouse, and a hospital. On the neighbouring hills are many vineyards, which produce good red wines, and there are two noted hot springs. There are manufactures of linen and woollen cloth, leather, shoes, and harness.

Erlking (Ger. *Erkönig*), erroneous forms for elf-king and *Elfenkönig*=king of the elves. The German form, introduced by Herder, was made popular by Goethe's ballad. [FAIRIES.]

Ermine (*Mustela erminea*), a small vermiform carnivorous mammal allied to the weasel (q.v.), from which it chiefly differs in its coloration and its greater size. It is generally distributed in the higher latitudes of the northern hemisphere, and occurs in the southern parts of Britain, and in this country it is called the stoat. In summer the upper parts vary from yellowish to mahogany brown, and the under parts are white tinged with sulphur yellow, while the throat is pure white. The general hue of the winter dress is white, with tinges of sulphur yellow. The tail is always tipped with black. The total change only occurs in higher latitudes, whence the ermine fur, used chiefly for trimming state robes, is imported. The ermine feeds principally on rats, water-voles, and rabbits, but does not disdain birds, and sometimes it invades the poultry-yard.

Erne, any species of *Haliaeetus*, a genus of eagle in which the legs are not feathered. There are seven species, almost universally distributed, being absent only from South America. The Common Erne, or White-tailed Eagle (*H. albicilla*), is a rare British bird found only in the extreme north of the island, though it is widely distributed

in the north of Europe and Asia. It is about three feet long, with brown plumage, which is lighter on the head than elsewhere, and in adult birds the tail is white. The White-headed or Bald Eagle (*H. leucocephalus*), the emblem of the American Union, is slightly smaller than the British species. Full-grown birds have the head and neck, as well as the tail, white; the rest of the plumage is brown. All the species frequent rocky coasts or wooded ground near inland lakes, feeding on birds and small mammals, like the true eagles, but supplementing the diet with fish, which some species obtain by robbing more expert fishers. This evil propensity in the bald eagle occasioned Franklin's regret that it should have been chosen by his countrymen as the national emblem.

Erne, LOUGH, in Fermanagh, Ireland, is really an expansion, or rather two expansions, an upper and lower, of the river Erne, which rises in the county of Longford and flows N. through the county of Cavan, and after forming the lough flows into Donegal Bay. The upper lake is 12 miles long by 2 broad, has many islands and flat marshy shores. The lower lake is 15 miles long by 5 broad, and has lofty shores with ruined castles on some of the heights. Trout, salmon, and other fish are abundant.

Ernesti, JOHANN AUGUST (1707-1781), a German theologist and grammarian, was born in Thuringia, and studied at Wittenberg and Leipzig, devoting himself especially to ancient literature and philology. In 1742 he was appointed professor of ancient literature in the Leipzig University, and in 1759 professor of theology. He was noted for his biblical exegesis and criticism, and still more for his editions of the classics. His elegant Latin style gained him the name of "the German Cicero."

Erpenius (VAN ERPEN), THOMAS (1584-1624), an Orientalist, born at Gorkum in Holland. At Leyden he studied Oriental languages under Joseph Scaliger, and made the acquaintance of scholars during his travels over Europe. In 1612 he became professor of Arabic and other Oriental languages at Leyden, and set up an Oriental press. He was also professor of Hebrew, Oriental interpreter to the States-General, and was employed by the King of Spain to read Moorish inscriptions. He published Hebrew and Arabic grammars, and a history of the Saracens, and was contemplating other works of a similar nature when death overtook him.

Errantia, a sub-order of worms belonging to the Polychæta (q.v.), and including all those members of this order which are free and carnivorous; in the second sub-order, or Tubicola, the worms all live in tubes and are vegetarians. The principal families included in this sub-order are the Sea-nice (*Aphroditidae*) and the Nereids (*Nereidae*).

Error, a fault in the pleadings or process or judgment in an action upon which formerly a writ of error was brought by the complaining party. The Judicature Acts abolished proceedings "in error," and substituted an appeal in all cases where the Court of Appeal had occasion to deal with what

had taken place in the High Court, and they have given to the Appeal Court much more elastic powers than were exercised in the previous Court of Error, having provided in effect that the Court of Appeal shall have all the powers and duties as to amendment and otherwise of the Court of First Instance, with full discretionary powers to receive further evidence (not raising an altogether new and inconsistent case) upon *questions of fact*, and generally to give such judgment as ought to have been given in the High Court, and the Court of Appeal may also thus deal with any order made in the action. Special provisions are made regulating the cause and manner of appealing. As to criminal cases—after a judgment given against the prisoner either at the assizes or sessions, if there be a substantial defect in the indictment, or error apparent in the Record, such judgment may be reversed by the King's Bench Division of the High Court. But the Attorney-General's fiat must be first obtained, which in misdemeanours, on sufficient cause shown, is granted as a matter of course, but in felonies is granted only *ex merâ gratiâ*. The Attorney-General may confess error, and so consent to a reversal of the judgment.

Errors. Observations are of various kinds, and require different senses. Thus observations of length are most generally done by sight; in measuring the length of a table, a scale or rule of known length is placed in contact with the table and a comparison effected by sight. They may be done by the sense of touch also; if a bar is to be turned in a lathe so as to be exactly one inch in diameter, it is convenient to test its diameter with a pair of callipers opened out to one inch, and the sense of touch helps to compare the two. Again, observations of time are usually done by sound, though other means may also be adopted. But on whatever sense the observation depends, absolute accuracy cannot be obtained. The sense is not sufficiently refined, nor are the instruments. The first introduces what are called errors of observation, the second errors of adjustment. The latter may be eliminated when careful testing of the instrument has been effected and an estimate of their errors obtained; or they may, in a sense, eliminate themselves by repeating the observation in different ways and taking the average result. Certain errors of observation are fortuitous, and there is as much likelihood of an error one way as the other. Thus if a hundred average men take a measurement of the same length to one-tenth of an inch it will probably be found that they differ among themselves as to the correct result. But there will be about as many below the average as there are above. The average is the best result that can be taken, though the fact that there is a difference of result shows that this answer cannot be taken as perfectly correct. The majority of the hundred answers will closely approximate to the average, and large errors will occur in but few cases. The method of Least Squares (q.v.) shows to what degree of accuracy this average may be expected to be correct. Personal errors that are not fortuitous generally admit of elimination in

the same way as do errors of adjustment, *i.e.* either by determining the *personal equation* (q.v.) of the observer, or by repeating the observation in different ways and taking the average.

Ersari, a large division of the Turkoman nation, whose territory stretches along the left bank of the Middle Oxus, and whose chiefs recognise the political authority of the Khan of Bokhara. They appear to be increasing in numbers, having advanced from 50,000 tents and 250,000 souls, Vambéry's estimate in 1875, to 60,000 tents and 300,000 souls, General Obruchef's estimate in 1886. From their geographical position the Ersari are commonly known as the *Lebab Turkomans*, that is, "River Turkomans."

Erskine, EBENEZER (1680-1756), a Scottish clergyman who founded the Secession Church of Scotland. He studied at the University of Edinburgh, and was appointed pastor of Portinok in Fife in 1703, and stayed there 28 years, removing afterwards to Stirling. He left behind sermons which were published in five volumes after his death.

Erskine, the HON. HENRY (1746-1817), a noted Scottish barrister, born at Edinburgh, was a son of the Earl of Buchan. His great talents won for him a high place in the profession, and his other qualities caused him to be much esteemed. Being a Whig he was appointed Lord Advocate in the Rockingham administration, but on its fall he suffered professionally on account of his political views. In 1806 he was again Lord Advocate and M.P. for the Dumfries burghs. The latter part of his life he passed in retirement through ill-health.

Erskine, JOHN (of Carnock) (1695-1768), a Scottish jurist and professor of Edinburgh University. He became an advocate in 1719, and professor of Scots law in 1737. In 1754 he published *Principles of the Law of Scotland*, which was much esteemed as a text-book. He resigned his professorship in 1765, and devoted himself to writing his *Institute of the Law of Scotland*, which was published after his death, and new editions of which, brought down to date, are still highly valued.

Erskine, JOHN, D.D. (1721-1803), son of John Erskine, was intended for the legal, but was drawn by his tastes to the clerical profession. In 1758 he was appointed to the New Greyfriars Church at Edinburgh, and in 1767 to Old Greyfriars. He headed the Evangelical party in Scotland, and for his personal character was much esteemed even by his opponents, who were led by Dr. Robertson. Scott pays a compliment to his eloquence in *Guy Mannering*, where Mr. Pleydell takes the Colonel to hear him on Sunday morning. He left behind him controversial writings and some moderate Calvinistic sermons.

Erskine, THOMAS, LORD (1750-1823), brother to the Hon. Henry Erskine mentioned above, was a renowned advocate, and less renowned Lord Chancellor. After an education at the Edinburgh High School and St. Andrew's University, he served as a midshipman in the navy for four years, and then

in the army for six years. In 1777 he entered at Trinity College, Cambridge, and at Lincoln's Inn, and in 1778 he was called to the bar, where he achieved such success as to justify his taking silk in 1783. His forensic skill at the trial of Admiral Keppel caused the electors of Portsmouth to return him to Parliament, and to keep him there till he became a peer. He was a great advocate of the rights of juries, and his attitude in the libel trial of the Dean of St. Asaph brought him into collision with Mr. Justice Buller, who had been his trainer in special pleading. His defence of Mr. Stockdale was a great oratorical exhibition. For defending Thomas Paine, in 1792, he lost his position as Attorney-General to the Prince of Wales, but in 1802 he was restored to the post, and in 1806 Lord Grenville made him Lord Chancellor, and he became a peer. This was on the whole a misfortune for him, since the administration was short-lived, and it was against etiquette for him to return to the bar. Moreover, his powers as an advocate were not equalled by his powers as a judge. Among his literary works were a pamphlet upon the war with France, the editing of some State trials, a preface to Fox's speeches, and a political romance. Many of his speeches at the bar have been published, notably, in Chauncey Goodrich's collection of *British Eloquence*, as well as separately.

Erubescite, or BORNITE, $3\text{Cu}_2\text{S}_2 \cdot \text{Fe}_2\text{S}_3$, is a very valuable ore of copper, of which metal and iron it is a sulphide. It crystallises in the Cubic system; but is most commonly massive. It is of a pale reddish-yellow colour, or varies from copper-red to pinchbeck-brown, but tarnishes so rapidly, on exposure to red, brown, and then violet, or blue, that it is known as "variegated" or "purple copper-ore," or in Cornwall as "horse-flesh ore." It has metallic lustre, a greyish-black streak and an uneven fracture, is brittle, and has a hardness of 3 and specific gravity 4.5 to 5.5. When heated it gives off sulphurous fumes, and can be reduced to a brittle magnetic bead. It dissolves in nitric acid, the sulphur remaining as a residue. It occurs at Dolcoath and elsewhere in Cornwall, is plentiful in Chili, Peru, and Mexico, and is found at Killarney, and, associated with malachite and baryte, in Connecticut.

Erulars (*Irulas*), an aboriginal tribe of the Nilghiri Mountains, South India, of extremely dark complexion, as indicated by their name, which in Tamil means "black as night." They occupy the foot of the hills just below the Kurumbas, and in their physical appearance are intermediate between the Kurumbas and the Hindu Pariahs (low castes) of Madras. There are two classes, the *Urals*, or chief, and the *Kurmtali*, or peasants, who raise a little corn scarcely sufficient for the daily wants of the tribe. The Erulars occupy an extremely low stage of culture, but although living in a promiscuous state the two classes always keep entirely aloof. Their language is a Tamil dialect mixed with Kanarese and Malayalam elements, and they number about 41,000.

Eryonidae, a family of lobsters (Macrura) of which the type-genus *Eryon* occurs in the Jurassic

rocks; some remarkably well-preserved examples have been found in the Solenhofen Slate.

Erysipelas (from two Greek words signifying a red skin), or ST. ANTONY'S FIRE, a febrile affection associated with inflammation of the skin. The affected part (usually the head or face) is swollen, red, hot, and raised above the surrounding skin. Erysipelas usually occurs in connection with a wound (traumatic erysipelas). It is sometimes attended with high fever and much constitutional disturbance. One attack of the disease does not, as in the case of scarlet fever, measles, etc., protect the individual against subsequent attacks, but on the contrary, seems to render him predisposed to further occurrences of the malady. Erysipelas appears to be due to the invasion and growth within the body of a germ, the *micrococcus erysipelatos*. The disease used to be of common occurrence where large numbers of persons suffering from wounds were grouped together, but of late years the advances made in antiseptic surgery have greatly minimised the mischief formerly wrought by the disorder in hospitals. The treatment of erysipelas is in the main that of other fevers; depletion is badly borne, and a liberal diet should be administered. Preparations of iron are usually given, and the local applications employed are poultices and simple ointments; or a dry powder such as a mixture of zinc oxide and starch is dusted on to the inflamed part.

Erythema, a skin disease in which diffuse redness of the cutaneous surface occurs. The term is very loosely applied. Erythema often occurs in rheumatic subjects. A well-marked form of erythema is *Erythema nodosum*, in which affection exceedingly painful, reddened, and raised patches are noticeable, usually involving the skin of the leg over the shin bone.

Erythrite, **Erythrine**, or COBALT-BLOOM, $\text{Co}_3\text{As}_2\text{O}_8 + 8\text{H}_2\text{O}$, a hydrous arsenate of cobalt, occurs with other ores of that metal, and is used in the manufacture of smalt. It crystallises very regularly in modified prismatic forms belonging to the Oblique system with perfect cleavage yielding flexible laminae; but is more often found earthy. It is crimson or peach-blossom red, with a paler streak drying to lavender-blue; translucent, vitreous to adamantine in lustre on some faces, but pearly on those of perfect cleavage. It is sectile, having a hardness from 1.5 to 2.5 and a specific gravity about 3. On heating it gives off water and a sublimate of arsenic: it colours the flame light-blue, gives a deep blue bead with borax and a rose-red solution in hydrochloric acid. It is found in Cornwall, near Alston in Cumberland, at Schneeberg in Saxony, and elsewhere.

Erythrol (ERYTHRITE), a tetrahydric alcohol of the formula $\text{C}_4\text{H}_{10}\text{O}_4$, its constitution being represented by $\text{CH}_2\text{OH} \cdot \text{CHOH} \cdot \text{CHOH} \cdot \text{CH}_2\text{OH}$. It forms large dimetric crystals and, like most polyhydric alcohols (*comp.* glycol, glycerine, sugar, etc.), has a sweet taste. It occurs in combination in various lichens and in *Protococcus*. It undergoes fermentation under the influence of certain

bacteria, yielding butyric acid ($C_4H_7O_2$) as a product.

Erserum, a city of Turkish Armenia, 100 miles S.W. of Trebizond, forming the chief outpost against the Russians in that direction. The town consists of a central, strongly-walled citadel, and surrounding suburbs. There are many mosques, Armenian churches, bazaars, and caravanserais, and the streets are, for the most part, narrow and squalid. There are many manufactures of copper and iron goods, and the position of the town on the great roads between E. and W. leads to considerable trade. The inhabitants are chiefly Turks, Armenians, and Persians. There was a fortress here in the time of Theodosius. It became Turkish in 1517, and in 1829 was taken by the Russians, who again besieged it and held it for a time in 1877-78. In 1895 it was the scene of a massacre of Armenians by the Turks.

Erzgebirge, a mountain chain between Saxony and Bohemia, rising to a height of about 4,000 feet. The mountains are rich in minerals, whence their name, which means ore-mountains. Among the minerals are arsenic, cobalt, copper, iron, lead, and silver, and the formations are chiefly granite and gneiss, with clay slate, basalt, and, in the Bohemian part, brown coal.

Eschar, a slough, or portion of dead tissue. An *Escharotic* is a form of application used for artificially producing an eschar.

Eschara, a genus of marine Bryozoa (q.v.), including those which form large calcareous leaf-like colonies. It has, however, been found that representatives of many different genera and families have been included under this term, and the genus has consequently been abandoned.

Eschatology (Greek *eschatos*, last), that part of theological science which attempts to establish a theory of the lot that awaits man in a future world, and which deals with what are called the four last things: Death, Judgment, Heaven, Hell.

Escheat, from the Norman-French *eschet*, which is from the word *eschier* or *eschoir*, to fall; for an escheat is a casual profit, which falls to the lord of the fee, from whom, or from whose ancestor, the estate was originally derived, taking it as *ultimus hæres* upon the failure, natural or legal, of the intestate tenant's family. It differs from Forfeiture (now abolished for treason or felony) in that the latter is a penalty for a crime personal to the offender, of which the Crown is entitled to take advantage by virtue of its prerogative; while an escheat results from tenure only, and arises from an obstruction in the course of descent. It had its origin in feudal times; while forfeiture affects the rents and profits only, escheat operates on the inheritance. Escheat follows, then, on default of heirs, when the tenant dies without any lawful and natural-born relations on the part of any of his ancestors, or when he dies without any lawful and natural-born relations on the part of those ancestors from whom the estate descended, or where

the intestate tenant, having been a bastard, does not leave lineal descendants, since he cannot have any collateral descendants. It also arose from corruption of blood (now abolished by 33 and 34 Victoria, c. 23), when the tenant had been convicted of treason or felony. For the protection of beneficiaries of estates the statute law has made an exception to the general law of Escheat in the case of a trustee or mortgagee dying intestate and heirless (13 and 14 Victoria, c. 60), and by the Intestates' Estates Act, 1884, equitable estates and interests in incorporeal hereditaments (which prior to that Act did not escheat) are subject to the same law of Escheat as legal estates in corporeal hereditaments. The Intestates' Estates Act, 1884, also provides for the waiver by the Crown of its right by escheat in favour of the intestate's family, or of any person considered or adopted as part of his family as pointed out by the Statute 59 George IV., c. 94.

Eschscholtzia, a genus of herbaceous plants belonging to the poppy family, natives of California, named after the German traveller and naturalist, Johann Friedrich Eschscholtz (1793-1831). The calyx is "calyptrate," coming off like a cap; and there are four petals and an elongated siliqua-like pod of two carpels with parietal placentation. *E. californica*, the best-known species, has finely divided, glaucous leaves and yellow petals, orange at the base.

Eschweiler, a town at the junction of the Inde and Dente, in Rhenish Prussia, 9 miles N.E. of Aix-la-Chapelle. The principal industries are iron-works, glass, machine-making, and woollen, silk, velvet, lace, and leather manufactures. There are iron and lead mines in the neighbourhood.

Escobar y Mendoza, ANTONIO (1589-1669), a Spanish casuist, born at Valladolid, and educated by the Jesuits, whose order he entered at an early age. He became renowned as a preacher, and preached daily for 50 years. His writings made 40 folio volumes. Among the chief of them are *Summula Casuum Conscientiarum*, *Liber Theologiae Moralis*, and *Universæ Theologiae Moralis Problematæ*. He also wrote some Latin poems. He was an advocate of the doctrine of expediency, and his views were attacked by Pascal in his *Provincial Letters*.

Escorial, THE, a palace of the Kings of Spain, now falling to decay, situated 2,700 feet above the sea level in the Sierra Guadarrama, between old and New Castile. It was built in fulfilment of a vow by Philip II. between 1563 and 1584, and was intended to represent the gridiron which was the instrument of the martyrdom of St. Lawrence, to whom it was dedicated. Besides the palace, it formerly contained a monastery and a chapel, the palace and chapel being, so to speak, in the handle of the gridiron. The parallelogram which represents the body of the instrument is 744 feet by 580. Towers of 200 feet in height at the extremities represent the feet, and the tower of the church is 330 feet high. The Kings of Spain are buried beneath the church. There is a good library, with

many Greek and Arabic MSS., and there is a very fine collection of paintings.

Esk, the name of several rivers in Scotland, the word meaning *water*. Of the seven Scottish rivers of the name, three are in Dumfries, part of which has the name of Eskdale, two are in Forfarshire, and two in Edinburghshire.

Eskimo (**ESQUIMAUX**), a North American people, who are thinly spread over the whole of the Arctic regions from Behring Strait to Labrador and both sides of Greenland, but who are almost exclusively confined to the seaboard, scarcely anywhere ranging more than 100 or 150 miles inland. Although everywhere presenting great racial and linguistic uniformity, they have no general national name, calling themselves *Innuît* (sing. *Inuok*) in parts of Alaska and the Melville Peninsula; *Chiglit* (sing. *Chiglerk*) about the Lower Mackenzie; *Agertit* (sing. *Aggut*) on the west side of Hudson Bay; *Karalit* or *Kalalit* in Greenland; all of these terms simply meaning "men," "people." **Eskimo**, the name given to them by their Algonquin neighbours, has reference to their taste for uncooked food, being derived from *aski* = raw, and *mowen* = he eats, whence *askimow* = he eats raw meat, or *askimowew* = he eats it raw. Physically they stand quite apart from the other American aborigines, resembling the Chukchis, Samoyedes, and other primitive Siberian peoples in their squat, thick-set figures, round, flat face, high cheek bones, narrow brow, small, broad nose, thin lips, deep-set, oblique eyes, receding chin, yellow-brown complexion. The beard is scant and bristly like the whiskers of a cat (Hayes), and the hair is of the black, lank, coarse texture common to all Mongolo-American peoples. A highly characteristic feature is the dolichocephalic (long) skull, which grows more marked from west to east, reaching its extreme development among the Greenlanders. The height, averaging about 5 feet 3 or 4 inches, varies considerably, and Dale describes the Eskimo studied by him in Alaska as even a tall, fine people, intelligent, shapely, of athletic form, differing, in fact, in most respects from the popular idea of this race. According to Rink, perhaps the best authority on the subject, the original home of the Eskimo was in Alaska, whence they gradually moved along the lines of least resistance round the shores of the Arctic Ocean eastwards and southwards to Greenland and Labrador. They may have either reached Alaska from Asia across Behring Strait, or, as many suppose, from the interior of North America, the physical differences now separating them from the Redskins being due to long isolation and gradual adaptation to their changed environment. This view is supported by the fact that the language is distinctly of the polysynthetic American, and not of the agglutinating Asiatic type. A few Eskimo groups are certainly found on the Asiatic side of Behring Strait, but these appear to be later immigrants from Alaska, and consequently do not represent the primordial stock of the American Eskimo. Despite the vast extent of their domain, the Eskimo are far from a numerous people, numbering altogether probably not more than 40,000,

of whom 12,000 are in Alaska, 4,000 in Labrador, 10,000 in Greenland, and the rest in the intervening Arctic regions. Occupying lands almost destitute of vegetation, all are necessarily fishers and hunters, preying according to the seasons and surroundings on the whale, seal, walrus, otter, beaver, salmon, aquatic birds, the wolf, fox, musk ox, and reindeer. Unlike the Samoyedes and other Asiatic hyperboreans, they have rarely succeeded in taming the reindeer, their only domestic animal being the half-savage Eskimo dog, which is trained to draw the sledges and render them other useful services. The Eskimo are warmly attached to their bleak Arctic homes, where they defy the rigours of the climate wrapped in ample fur or sealskin garments, and generally sheltered in earthen-driftwood or snow huts half-buried in the ground, and roofed with mosses, lichens, and even the skins of wild animals. They display great skill in the construction of these dwellings, as well as in the preparation of their harpoons, household utensils, and especially their boats, of which there are two kinds, the *kayak*, 16 to 18 feet long, and tapering at both ends from about 18 inches in the middle, used only by the men for fishing purposes; and the *umiak*, or family boat, large enough to contain 30 or 40 persons, with which voyages of thousands of miles have been made along the coasts. Although ethnologists speak of Eskimo tribes, the tribal organisation is undeveloped; their small scattered communities are completely independent, recognising no chiefs, scarcely even the paternal authority. Three social divisions, however, have been distinguished: the family; the group of families all residing in one large house in winter, an arrangement confined mainly to Greenland; and the *mute* or village, a mere aggregate of families living together for convenience, but without any political organisation. These *mutes* are generally named from some local feature, as, for instance, Sikosuliar-mute, "Village of the Iceless Shore," on the Hudson Strait, and then the same term is applied collectively to all the inhabitants, as if it were their common tribal name, whence the numerous "tribes" all ending in *mute* which figure in ethnological works. The Eskimo religion—generally designated as Shamanism—is equally rudimentary, being limited to a belief in witchcraft and malevolent spirits, which have to be conjured or propitiated. If there are any good spirits about, they are harmless, and need no consideration. The Greenland Eskimo—those at least on the west coast—have long been nominal Christians, converted in the 18th century by Danish missionaries, who have reduced their dialect to written form. The greater part of the Southern Alaska Eskimo and the Labradorians are Christianised. These Labrador Eskimos are supposed to be the descendants of the fierce Skrällinger who offered a stout resistance to the Norse settlers in that region in the 14th century. (B. Seaman, *Anthropology of Western Eskimoland*, in *Anthropological Journal*, 1865; Hall, *Life with the Esquimaux*, 1854; Cl. R. Markham, *On the Origin and Migrations of the Greenland Esquimaux*, in *Journal of the Royal Geographical Society*, xxxv.; H. Rink, *Tales and Traditions of the Eskimo*, 1875.)

Eskimo Dog, a half-wild variety of the dog, used in Arctic regions for drawing sledges. It shows traces of its ancestry in its form and colour, and in its wolf-like note and temper.

Eski-Türk, that is, "Old Turks," a term often applied to the Kizil-bash Turkomans of Asia Minor, who are quite distinct from the Turkish peasantry of that region. W. Gifford Palgrave describes them as "a sort of eastern Mormonites, with a dash of Persian or Shiah superstition" (*Report on the Province of Trebizond*, 1868, part ii.).

Esne (anciently *Latopolis*), a city on the left bank of the Nile, in the Thebaid, Upper Egypt, 28 miles S.W. of Thebes. The great temple of Esne, one of the best specimens of Egyptian architecture, is now represented by a fine portico of 24 columns, having a zodiac upon the ceiling. Some have thought the temple and its portico to be very ancient, but the prevailing opinion now is that it dates back no farther than the time of the Emperor Claudius, and that the zodiac is even later. The Sennaar caravans use the town as an *entrepôt*, and there are potteries, shawl manufactures, and a cotton mill.

Esocidae. [PIKE.]

Esoteric (Gk. *esō*, within), an epithet used in philosophy to denote the more abstruse doctrines of a system, which were kept for the special disciples and initiated, and were considered to be above the capacity of those who were allowed to be fitted to receive the more general and *exoteric* (Gk. *exō*, without) principles of the system. Although Aristotle was said to have had esoteric doctrines, he himself only speaks of exoteric discourses, and then probably does not use the word in the sense that has been attributed to it. Pythagoras, too, was said to have had the two parts in his system, and we read of "esoteric Buddhism." Shakespeare uses in a somewhat similar sense the phrase "caviar to the general."

Esots, an Afghan tribe occupying the hills west of Dera Ishmail Khan, said to be of Kakar origin [KAKAR], but now distinct; live mostly in caves, and are amongst the rudest of all the Afghan peoples; two divisions—*Nahzæ*, with six branches; *Muldaæ*, with seven branches.

Espalier (It. *spalla*, a shoulder, and *spaliera*, a wainscot to lean the shoulder against) is a word used in fruit gardening, sometimes to denote a kind of lattice-work against which fruit-trees, especially apples and pears, are trained as against a wall, and sometimes used to denote such fruit-trees, or even a row of them.

Espartero, BALDOMERO, DUKE OF VITTORIA (1792-1879), a Spanish statesman, was born in La Mancha. In 1808 he entered the Students' Battalion during the War of Succession, and in 1814 he went to South America, where he fought under Bolivar. In 1836 he was again in Spain, and was Captain-General of the Basque provinces against the Carlists, against whom he gained several successes. As a reward for this he was created a grandee of Spain and Duke of Vittoria. From 1840

to 1843 he was regent in place of Queen Christina, after which he came to England for a time. From 1854 to 1856 he was at the head of the government, and in 1870 was even proposed as a candidate for the crown, but in 1870 he threw his lot in on the side of King Alfonso.

Esparto. [ALFA.]

Esperanto.—A neutral international language invented by Dr. Zamenhof of Warsaw. It is based on the roots of the principal European languages, and as these are in many cases derived from Latin, Esperanto may be described as an extremely simplified form of Latin, which can be learnt with great ease. Quite half the roots are familiar to English speakers, and the construction of sentences and the grammar correspond to the English usage. The language has obtained great acceptance abroad, especially in France. There are numerous Esperanto societies in England, the chief of which are in London and Keighley.

Espirito-Santo, a Brazilian province, having Bahia on the N., Rio de Janeiro on the S., and the Atlantic on the E., with a length of 260 miles, a breadth of 120, and an area of 17,312 square miles. There are several rivers flowing into the Atlantic, and the coast, where the climate is healthy and the soil fertile, is populous. The mountains and forests of the interior are inhabited by wild Indians, and are little known. The chief exports are sugar, rum, cotton, and dye-woods.

Esquirol, JEAN-ÉTIENNE (1772-1840), a French physician, who made the insane his special study. He was born at Toulouse, and studied at Paris, and was appointed sanitary officer to the Army of the Pyrenees. He visited the lunatic asylums of France, and in 1811 was appointed physician to the Salpêtrière, and in 1823 was made inspector-general of the medical faculty. He wrote much upon madness, mental disease, and lunatic asylums.

Esquiros, HENRI ALPHONSE (1814-1860), a French poet, novelist, and politician, was born in Paris. His first work, *Les Hirondelles*, was published in 1834, followed shortly by a novel, *Le Magicien*, and another, *Charlotte Corday*. His *Évangile du Peuple* was a modernising of the life of Christ, something after the fashion of Mrs. Lynn Linton's *Joshua Davidson*. Imprisoned for his opinions, he wrote *Les Chants d'un Prisonnier*. In 1847 he wrote *Histoire des Montagnards*, and in 1851 *Histoire des Martyrs de la Liberté*. In this year he was expelled from France, and went to Holland and to England, where he became a professor at Woolwich. His sojourn in these countries gave him material for writing *La Néerlande et la Vie Hollandaise* and *The English at Home*. In his latter years he returned to France, and was elected to the Assembly.

Essence (Lat. *essentia*), the informing spirit of a thing; that which makes it what it is. In a metaphysical sense it is equivalent to the real nature of a class as expressed in the definition. In a physical sense it was said to be a quint-essence or some fifth thing apart from but underlying

the four elements. The word is used in chemistry generally to denote an alcoholic solution of the essential oil of a substance.

Essenes, a Hebrew sect, whose members were strict in observances, of ascetic habits and mystical tenets, and adopted the monastic life. Some have advanced the improbable theory that Christian teaching originated in the Essenes. Possibly St. Paul meant them when he spoke of "the strictest sect." They held communistic principles with regard to property. Nineteen etymologies have been at different times proposed as to the name. Many of them are said to have become Christian, and to have formed the mystic sect called *Therapeutæ*, and to have first established monasticism in the Christian Church.

Essen-Ili, a main division of the Turkoman nation, who occupy a wide territory in West Turkestan. According to Obruchaff (*Shornik*, iii. p. 80), they number altogether 115,000 souls, all under tents, and subject to Russia.

Essen-on-the-Berne, a town of Rhenish Prussia, 18 miles N.E. of Düsseldorf. It is chiefly noted as the seat of Krupp's gigantic iron and steel works. It is here that are manufactured the steel guns, large and small, that enjoy so great a reputation in the Continental armies. The firm has its own coal and ironstone mines, some of the latter being in Spain. The works cover 1,000 acres, and give employment to an army of workmen, who are treated with great consideration. Besides puddling and rolling-mills, there are manufactures of machinery, boilers, tobacco, and cigars.

Essential Oils are oils obtained by the distillation of various plants, usually with water. They are generally colourless or slightly yellow, of a low specific gravity, inflammable and odorous, and usually undergo alteration by exposure to air. Some appear to exist as such in the plants, but in other cases they are products formed by the alteration or decomposition of complex vegetable compounds. They vary in composition, but generally consist of a mixture of at least two substances—the one oxygenated as an alcohol, acid, or aldehyde, the other a hydrocarbon. They are very largely used for the manufacture of various scents, essences, etc.

Essequibo, the name of a river and of a settlement in British Guiana. The river flows into the Atlantic by a mouth twenty miles broad, but the entrance is partially blocked by sand banks. There are several islands in the river. The settlement is upon the river, and formerly belonged to Holland, but was made over to England in 1814. The country is fertile and well cultivated, its chief products being cocoa, coffee, sugar, and cotton.

Essex, a county on the south-east coast of England, to the north of the Thames, having Suffolk on the N., the German Ocean on the E., and Hertford and Middlesex on the W. It is 60 miles long by a greatest breadth of 45 miles, and contains 1,055,133 acres. The land is flattish, but has gentle hills and dales, save to the south and east, where it is

generally reclaimed marsh. Epping Forest (q.v.) has some beautiful woodland scenery. Essex is one of the first farming counties of the kingdom, and is specially noted for its wheat, its beans, and its peas, while other crops are above the average, and it cultivates also caraway, coriander, and teazel. There is much grazing on the marsh lands, and fattening of calves for the London market. Epping and its neighbourhood are famous for cream and butter, and fish are plentiful on the coast; while near Colchester and in the rivers Crouch and Roach there are extensive oyster-beds. Silk, crape, and straw-plait manufactures are the special industries. Besides the boundary rivers Thames, Lea, and Stour, the chief are the Chelmer, Colne, Crouch, Roding, and Blackwater. There are eight parliamentary divisions, returning one member each, and two parliamentary boroughs—Colchester (with one member), and West Ham (with two). The county town is Chelmsford, and then come Colchester, Harwich, a frequented port for the Continent, and Maldon. The county is served by the Great Eastern Railway. Pop. (1901), 1,085,576.

Essex, ROBERT DEVEREUX, EARL OF (1567–1601), a courtier of Queen Elizabeth's time. Educated at Trinity College, Cambridge, he came to court in 1584, and was made Master of the Horse and Knight of the Garter, and commanded the cavalry under Leicester in the Netherlands in 1587, and succeeded that nobleman in the Queen's favour. In 1590 he married Walsingham's daughter, the widow of Sir Philip Sidney. In 1596 he commanded the expedition which burnt Cadiz, and the next year he had a hand in the capture of some Spanish ships. In 1597 he was made Lord-Lieutenant of Ireland, but was unsuccessful in governing the country, and through petulance coquetted with the malcontents of all parties, and when summoned before the Council, resisted and committed overt acts of rebellion, for which he was beheaded in February, 1601.

Esslingen, on the Neckar, a town of Würtemberg in Germany, seven miles S.E. of Stuttgart. It is a walled town, and is defended by a castle. Among its public buildings are a Gothic church, with a tower 230 feet high, two town halls, and an ancient monastery. There are manufactures of machines, philosophical instruments, cutlery, articles in gold, silver, wood, and tin, and there are paper and spinning mills. In the Middle Ages Esslingen was an imperial free town.

Estate, a generic term indicating the extent of the title or interest of anyone in property of any kind. This is the legal signification of "Estate," which is not a piece of land or other property, but signifies the relationship between a man and property. The word was formerly used to signify a man's status or condition in life. It was also used to signify (as it still does) a class or order in the state. The law of England recognises two principal divisions of this subject, viz. *Real Estate* and *Personal Estate*, and in many respects there is a separate law peculiar to each.

Real Estate is an interest in land, and may be aptly treated under three heads: (1) the quantity

of estate, that is, the amount of the owner's interest therein; (2) the time when that interest commences and endures; (3) the quality of the estate, or the way in which it is to be enjoyed.

1. All real estate, not being of copyhold tenure [COPYHOLD], or what are called customary freeholds, is either freehold or less than freehold. Freeholds are freeholds of inheritance, or freeholds not of inheritance. Freeholds of inheritance are either inheritances absolute, called fee-simple, or inheritances limited, called qualified or base fees, or fees conditional. A freehold of inheritance absolute or fee-simple is the largest estate or interest which a man can have. The owner may freely dispose of it to whom he pleases in his lifetime by deed or by will, and if he dies without making any disposition it descends to his heir. A qualified or base fee has some qualification or limit annexed, which may determine the estate, as in the instance of a grant to A and his heirs, "tenants of the manor of Dale." Whenever A or his heirs cease to be tenants of that manor, their estate is determined—that is, at an end. An *estate tail* or conditional fee (popularly known as an entailed estate) is a fee restrained to some particular heirs, exclusive of others, as to a man and the heirs male of his body, by which limitation his lineal heirs, female and collateral, were excluded—hence, the origin of this estate. A freehold not of inheritance is an estate which the owner has for his life only, or the life of some other person, or until the happening of some uncertain events. (As to tenant by curtesy and tenant in dower, see CURTESY, DOWER.) Of estates less than freehold there are three descriptions—estates for years, legally known as chattels real, popularly as leaseholds, estates at will, and estates by sufferance. An estate at will arises where a man lets land to another expressly at the will of both parties, or without limiting any certain estate; either party may put an end to the tenancy when he pleases. An estate by sufferance arises where a tenant, who had entered by lawful title, continues in possession after his interest has determined. [LEASE.] All estates may be subject to a condition, or the happening or not happening of some uncertain future event, whereby the estate may be either created or enlarged or defeated. (2) Estates are either in possession or in expectancy. Estates in expectancy are divided into estates in remainder and reversion, and by executory devise or bequest; and, again, remainders are divided into vested and contingent remainders. (3) Estates may be enjoyed in four ways—viz. in severalty or by a single person, in joint tenancy, in coparcenery, and in common. (See those titles.) Estates are also legal or equitable. It is a legal estate when the owner is in the actual seisin or possession, and also entitled to the beneficial interest himself, or in trust for some other person. An equitable estate is when some other person, not the person who is the actual and legal owner, is entitled to the beneficial interest of the property, of which that other is in possession. The power of the beneficial owner over his equitable estate is as complete as if he were possessed of the legal estate.

2. *Personal Estate* consists of property, things, or chattels, etc., moveable of whatever denomination, whether alive or dead, as furniture, money, cattle, etc., for these things may be transmitted to the owner wherever he thinks proper to go, and may therefore be said to attend his person, according to the maxim—*mobilia ossibus inherent*. In many respects (notably on death in the absence of a will) a different law regulates personal estate. The devolution of personal estate is prescribed by the "Statute of Distributions," passed in the reign of Charles II. [INTESTACY.]

Estate Duties. [DEATH DUTIES.]

Este, the name of an ancient Italian family which produced many illustrious men. Among the best-known of them are Alfonso I., who, after joining the league of Cambray and commanding the Papal army, was afterwards opposed to the Pope, and captured the Papal general Fabrizio Colonna. He was for a time restored by Leo X., but was afterwards excommunicated, and took part with Francis I. of France in his war with Charles V., afterwards joining the Emperor, who secured to him his possessions. In the reign of Pope Alexander VI. he married Lucrezia Borgia, by whom he became father of Ercole II., whose wife, Renée of France, favoured Calvin and the Reformers. His son, Alfonso II., imprisoned Tasso in the madhouse for seven years for raising his eyes to the Princess Lucrezia. His cousin and heir Cesare was excommunicated by the Pope and deprived of Ferrara, after which the family steadily declined, and in 1859 the duchy was annexed to Sardinia.

Esterhazy von Galantha, a noble Hungarian family dating from the 13th century. They aided the House of Hapsburg, and did important services to Frederick II. and Leopold I. In the 13th century the family divided into two lines, one of which became extinct in 1838. The name was changed to Esterhazy in 1584 by Francis Terhazy, who was vice-regent of the county of Presburg. This Francis had four sons. The descendants of one of these failed in 1670, but of the houses founded by the other three two received the title of Count in 1683, and Nikolaus, the founder of the third, was made Margrave of Forchestein in 1626.

Esters, a name applied to the class of bodies known as ethereal salts—i.e. compounds of an alcohol and acid. It is generally restricted to the ethereal salts of organic acids, and, although formerly not much used except by German chemists, the word is now adopted in English chemical nomenclature.

Esther, a Jewess who was married to Ahasuerus, King of Persia, and whose adventures and danger from Haman, and advocacy of her people, are recorded in the Book of Esther, which, however, is often regarded as altogether apocryphal. Those who believe in its historical accuracy are in doubt whether Darius or Xerxes is spoken of under the name of Ahasuerus.

Estheria, a genus of Phyllopoda (q.v.), in which the animal was protected by a bivalve shell.

It lives in estuaries, and has survived since Silurian times. *Esteria minuta* is one of the commonest fossils in the English New Red Sandstone.

Esthonia, a Russian maritime government having the Gulf of Finland on the N., St. Petersburg on the E., Livonia on the S., and the Baltic on the W., and including Oesel, Dagoe, and some less important islands, the whole area being about 7,600 square miles. The country generally is flat or undulating, except in the north, where there are high cliffs. The climate is healthy though moist; but the soil is not very fertile, a good deal of it being sandy, or covered with gravel and boulders. Some cereals are grown, together with flax, hops, and tobacco. The only river of any size is the Narva, but there are small streams and lakes, and there are pine, birch, and alder forests abounding in game. Fish is plentiful, and there is an export of hides and salt fish, and spirits are distilled and exported. The land is chiefly cultivated by Germans and Danes, but the peasants are Finnish in blood and language. The four districts of Esthonia are under the Governor-General of Riga, and are named Revel, Hapsal, Weissenstein, and Wesenberg.

Esthonian, a historical Finnish nation long settled on the southern shores of the Gulf of Finland, where they give their name to the Russian province of Esthonia; but for centuries they have been mere serfs on the large estates which are owned by German and Danish nobles, though their social condition was much improved by the Imperial edicts of 1804 and 1816. They are first mentioned by the Greek navigator Pytheas (about 340 B.C.) under the name of *Æstii*, which is evidently the *Egystur* or "Eastlanders" of the Norse chronicles, and they were known to King Alfred (Orosius) by the same name. This Germanic word has even been adopted by the people themselves, who often call their country *Eesti-Maa*, though the more usual expression is *Meie-Maa*, "Our Land." The Esthonian confederacy, which held its national assemblies at Rugala, had to recognise the supremacy of the Danes in the 11th century; and in 1317 Waldemar IV., King of Denmark, ceded his rights to the Teutonic Knights, under whose administration German influences became dominant. Nevertheless, the rural classes preserved their nationality and their Finnish language, which is still spoken in two varieties (those of Revel and Dorpat) by about 700,000 Esthonians and their Livonian kindred. But this language, which at one time prevailed throughout the whole of the Baltic provinces, is now extinct in Kurland. Its literature is mainly confined to religious works, chronicles, and national songs, printed chiefly in Dorpat. The Esthonians are nearly all Lutherans, and, although they have been Russian subjects since the Treaty of Nystad (1721), the Russian language and religion have hitherto made little progress amongst them. (H. H. Howorth, *The Finns and Some of their Allies*, in the *Journal of the Anthropological Institute*, 1871; Rutenberg, *Geschichte der Ostsee-Provinzen*, Leipzig, 1860.)

Estoppel, a bar or impediment to the exercise of some right, arising from a man's own act or the

act of some person, through whom he claims. There are three kinds of estoppel, viz. :—(1) *Estoppel by record*, as letters patent, pleadings, etc. Thus, in an action against a patentee by his assignee, the patentee is estopped from pleading that the patent is invalid. (2) *By matter of writing* as by deed, etc., parties and privies are stopped from alleging anything contrary to the deed. (3) *By matter in pais* (in the country), that is, transactions not evidenced by record or writing as livery, entry, acceptance of rent, etc. Thus, after acceptance of rent a landlord cannot treat his lessee as a trespasser.

Estover. This word, which is derived from the French *estoffer*, to furnish—i.e. stuff—is used to denote certain rights enjoyed by persons having only a limited estate or interest in land, being rights necessary to the enjoyment of that estate or interest. There are three kinds of estovers, viz. :—(1) *Housebote*, being a sufficient quantity of wood for fuel and repairs of the house. (2) *Ploughbote*, being a sufficient quantity of wood for the making and repairing of agricultural implements. (3) *Haybote*, being a sufficient quantity of wood for the repair of fences. Estovers must by law be reasonable; also they must be strictly applied to their respective purposes and to none other. Any excess in the enjoyment or misapplication of the just amount would constitute waste.

Estranghelo, the old Syriac alphabet of square monumental form, which is derived from the Phœnician, and which is itself the parent of the ordinary cursive Syriac script, of the Kufi-Arabic and Syro-Chaldean. The letters are extremely bold and elegant, and are consequently still much used for title-pages, ornamental work, deeds, and records.

Estreat (from the Latin *extractum*) indicates a copy or extract from the Book of Estreats—i.e. the rolls of any court in which the recognisances, amercements, or fines, etc., taken or imposed by such court upon or from an accused person, and which are leviable by the proper officer of the court. Recognisances are *estreated* when they are forfeited by the accused person's neglect to comply with the condition of the recognisance, by failing to appear or otherwise.

Estrela. [WAXBILL.]

Estremadura, a Portuguese province on the coast, having the province of Beira on the N. and E., Alemtejo on the S., and the Atlantic on the W. The Tagus flows through it, dividing it into almost equal parts, the northern of which has a mountain range reaching a height of over 2,000 feet, and containing the heights of Torres Vedras, and ending near the mouth of the Tagus. This ridge has a flat, sandy district on the west, but a fertile land to the south-east. Wine and olives are produced, and many fruits, and cork is obtained from the forests. Many swine are reared. There are minerals, but they are not worked; and there is some manufacture of woollen and linen. Most of the trade is seated in Lisbon, capital of the province and of the country, and at Setubal.

Eta (Gk. Η, η), the seventh letter of the usual Greek alphabet.

Eterio (from the Greek *hētairia*, a brotherhood), a term applied to polycarpellary apocarpous fruits, in which the numerous separate carpels may be either dry and indehiscent one-seeded "achenes," as in the buttercups, cinquefoils, strawberry, and rose; dry but dehiscent and many-seeded "follicles," as in columbine, hellebore, and magnolia; or succulent "drupelets," or miniature drupes, as in raspberry and blackberry. [FRUIT.]

Etawah, a town of N.W. Hindustan, capital of a district of the same name in the province of Agra, 70 miles S.E. of Agra. The town, on the bank of the Jumna, occupies a number of heights separated by deep ravines. It was once of importance, but is now decaying. The district is watered by the Jumna and the Ganges, and the climate, much modified by recent planting of trees, is good from October to May, but in spring hot winds prevail. Cotton, indigo, sugar cane, and many European fruits are the chief productions. It was once a favourite resort of Thugs, and was an important station of the revolted Sepoys during the Indian Mutiny.

Etching, a method of engraving (q.v.), (from old Dutch, *etsen*, to eat), consists in eating-in a design upon steel, copper, or other substance by means of an acid. The substance to be etched is covered with wax or composition, and the design is scratched through this down to the metal, and acid is then applied which eats into the substance wherever it is not protected by the wax. Albert Dürer is said to have been the first to adopt the method, and it was much employed by Rembrandt and his school.

Ethane, C_2H_6 , is the second member of the group of hydrocarbons known as paraffins (q.v.), and occurs naturally in the gases evolved from petroleum wells. It may also be prepared by numerous synthetic and other reactions. It is a colourless gas, which burns with a pale flame, is almost insoluble in water, and but slightly soluble in alcohol. By the action of chlorine, etc., substitution products are obtained in which one or more hydrogen atoms are replaced by the substituting body. In the nomenclature of such compounds the name of the substituent is placed before the ethane, as monochlor-ethane, C_2H_5Cl , chloro-brom-ethane, C_2H_4ClBr , etc. If only one hydrogen is replaced the resulting compound contains the group C_2H_5 which is known as *ethyl*, so that monochlor-ethane could be also called ethyl chloride. If two hydrogens are replaced by substitutes, two series of compounds can be obtained, (1) those in which the displaced hydrogens were attached to different carbon atoms, termed *ethylene* compounds as $CH_2Cl.CH_2Cl$; (2) those in which they were united to the same carbon atom, *ethylidene* compounds as $CH_3.CHCl_2$. Such isomeric [ISOMERISM] compounds exist also among the polysubstitution compounds.

Ethelbert (545-615), King of Kent, and Bretwalda, married Bertha the Christian daughter of

King Charibert of Paris. This marriage led to a visit of a Christian mission led by St. Augustine. The king and the greater part of his subjects adopted the new religion, and the church founded by the king is said to have been on the site of the present cathedral of Canterbury. The body of laws instituted by Ethelbert was the foundation of the Saxon code.

Etheldreda, St. (630-679), was a daughter of a king of the East English. She was twice married, the second time to Oswy of Northumbria; but the married state was distasteful to her, and she took refuge from it, first with her aunt Ebba, at St. Abb's Head, and then in the Isle of Ely, where she founded an abbey, now the cathedral. Her feast-day is the 17th of October, and she has the credit of giving the word "tawdry" to the English language.

Ethelred, the name of two Saxon kings of England. **ETHELRED I.**, brother and predecessor of Alfred, spent most of his reign in combating the Danes, and was mortally wounded in fight with them in 871. **ETHELRED II.** (966-1016)—called "the Unready" on account of his indolence of character—was the son of Edgar and Elfrida, who killed her stepson, Edward, in order to put her son on the throne. He was the first to introduce the payment of Danegelt, and his massacre of Sweyn's sister and other Danes led to the establishment of the Danish dynasty in England; while his marriage with Emma of Normandy, and his taking refuge at the Norman Court, was the indirect cause of the Norman conquest.

Ethene. [ETHYLENE.]

Ether. 1. In *Astronomy and Physics*. Between any two members of our solar system the existence of a force of gravitation may be demonstrated, and there seems no good reason for doubting that such gravitational force exists between any two masses in the universe. There must, therefore, be some medium between them to transmit such a stress. In the near neighbourhood of the earth an atmosphere of ordinary material gases exists, but at more remote distances such material is absent, and physicists are compelled to assume the existence of a medium of a special kind. Such a medium is the ether. But inasmuch as no entirely rational theory of gravitation has as yet been proposed, the possible properties of the requisite ether have not been pointed out. Again, light can reach us from the sun or other stars; there must, therefore, be an ether between these heavenly bodies that can transmit waves of light. A little more is known on the subject of light-waves than of gravitation, and various theories on the nature of the luminiferous ether have been propounded. Thus it is plausibly suggested that the ether is an extremely elastic solid, of great rigidity, but small density; that it behaves as a solid for such oscillations as occur in ordinary light-waves, but as a liquid for comparatively slow motions, such as that of the earth or other heavenly bodies passing through it—in fact, that it is a very viscous fluid, behaving like a solid for high speeds of displacement. Further, electro-magnetic displacement may be transmitted through a space void of

ordinary matter ; it also demands the existence of an ether. Mathematical and other considerations led Clerk-Maxwell to regard the electro-magnetic and the luminiferous displacements as similar, and as requiring only one ether. This is the basis of his electro-magnetic theory of light. It would simplify matters considerably if one ether could be suggested that possessed the requisite properties to transmit the various gravitational, electro-magnetic, and other effects. But different physicists at present regard the requisite properties differently, and one ether would have to be endowed with most paradoxical properties. The subject is, therefore, still very slightly understood. [MAGNETISM, VORTEX-THEORY.]

2. In *Chemistry* the term ether is, like the terms alcohol, aldehyde, etc., a generic name applied to compounds of the form $R.O.R^1$, where $R.R^1$ represent monovalent hydro-carbon radicals. They hence bear constitutionally the same relation to alcohols $R.O.H$. that metallic oxides bear to the corresponding hydroxides. If the radicals $R.R^1$ represent similar radicals the ether is called a *simple* ether, if different a *mixed* ether. They can be prepared by a number of general reactions, and by oxidation break up, and are oxidised to organic acids. In their general properties they resemble one another to a great extent. Ordinary *ethyl ether*, C_2H_5O , known also as *sulphuric ether*, or simply as *ether*, is a colourless mobile liquid, with a pleasant and characteristic odour. It is very inflammable, and as it boils at about $35^\circ C$. it gives off an inflammable vapour at comparatively low temperatures. It mixes with alcohol, chloroform, etc., and is slightly soluble in water. It forms a good solvent for fats, resins, and organic compounds generally, and is largely used by the chemist for such purposes. It is prepared by distilling a mixture of alcohol and sulphuric acid at about 140° , the alcohol being allowed to flow continuously into the distilling flask, at a rate such as to keep the temperature fairly constant. The ether which distils over is afterwards treated with quicklime and calcium chloride, and redistilled. (For the equation involved *vide* ETHERIFICATION.) Ether is largely employed in the chemical laboratory for a large variety of purposes, and frequently for the production of low temperatures. It is largely employed medicinally as an anæsthetic.

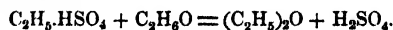
Etherege, SIR GEORGE (1636-1694), was a dramatist and wit of Charles II.'s reign. He was educated at Cambridge, and entered at an inn of court, after which he travelled in France and Flanders, and then devoted himself to literature, and became known as a writer of comedies. His three known comedies are *The Comical Revenge*; or, *Love in a Tub* (1664), *She Would if She Could* (1668), and *The Man of Mode* (1676). James II. knighted him, and he was appointed envoy to Ratisbon. He is thought to have accompanied the king to France after the Revolution, and to have died there, but the exact year of his death is unknown. There are some letters, poems, and papers of his in the British Museum, and an edition of his works was published in 1888.

Etherification, the term applied to the formation of ethers, or frequently also of ethereal salts or esters. In a restricted sense it signifies the formation of ordinary ether from alcohol and sulphuric acid. The reactions involved in this may be taken as typical ones, and appear to be as follows:—

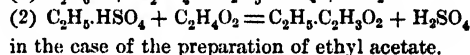
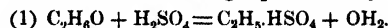
(1) The formation of ethyl-sulphuric acid from the alcohol and acid.



(2) Further reaction of the ethyl sulphuric acid with alcohol, ether being formed and sulphuric acid regenerated.



The formation of ethereal salts appears to be analogous. For this the alcohol and organic acid react upon one another in the presence of a strong acid, the reactions being represented by—



in the case of the preparation of ethyl acetate.

Ethine. [ACETYLENE.]

Ethiopia (etymologically, the land of "burnt faces"), called in Hebrew *Cush*, was a name used with differing signification in ancient times. It was sometimes applied to the regions of both Africa and Asia; at others, to the country south of Egypt and Libya from the Red Sea to the Ocean; and again to modern Nubia and Abyssinia—its capital being Meroe. There appear to have been many peoples and divisions. The language—called Geez—seems to have been a Semitic tongue, akin to Arabic, but having peculiarities of its own. This is no longer a spoken language, but exists in literature and in the Church, there being translations of the Bible and of certain uncanonical books. Christianity is supposed to have been introduced in the 4th century, and Dr. Wolff, the missionary, had some curious theories as to a Jewish element in Abyssinian Christianity dating from the time of King David. The country is spoken of in the Bible in connection with Egypt, and at times exerted a powerful influence upon Jewish history. Candace, Queen of Ethiopia, is mentioned in the New Testament. Some have thought that Egypt derived its civilisation in a great measure from Ethiopia; but modern researches go to prove that the tide of civilisation set the other way.

Ethiopian, a term of uncertain origin and varied application in ethnological treatises. For the Greeks all the peoples of Africa beyond Egypt were Ethiopians; but there were also Asiatic Ethiopians, and the term Ethiopia was, in fact, given to every region whose inhabitants were of a black colour, burnt, as was supposed, by the heat of the sun. the popular derivation being from *aithō*, to burn, and *ops*, face. Later, the Abyssinians, although Semites, adopted the word, and now call themselves "Ithiopian"; but under this designation modern ethnologists comprise the eastern branch of the Hamitic family, whose chief members are the Bejaas, Gallas, Somali, Danakil, and Agau. [HAMITIC RACES.]



ETHNOLOGY: RACE AND CULTURE

1. MONGOLIAN.

4. NEGRO.

2. NORTH AMERICAN INDIAN.

5. MAORI.

3. CAUCASIAN.

Ethiops Mineral, the name applied to a black compound obtained by heating sulphur and mercury in the proportion of about 1 to 6 parts, and from which by redistillation and treatment with water *vermillion* was obtained.

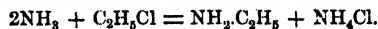
Ethmoid Bone (from a Greek word meaning a sieve) is a bone lying in the anterior portion of the base of the skull.

Ethnology (Gk. *ethnos*, a race, a people; *logos*, a discourse), properly that branch of anthropology which treats of the various fundamental divisions, subdivisions, and varieties of mankind. It is thus essentially different from *ethnography*, which is purely descriptive, dealing with the characteristics, usages, social and political condition of peoples irrespective of their mutual physical relations or affinities. The subjects of ethnography are the various groups of peoples taken independently one of the other; the subjects of ethnology are the same human groups regarded as so many co-related members of one or more primordial families. Hence, ethnology necessarily proceeds by the comparative method, co-ordinating its facts with a view to determining such questions as the antiquity of man; monogenism and polygenism; the geographical centre or centres of the evolution and dispersion of mankind; number and essential characteristics of human types; absolute and relative value of racial criteria (colour and texture of hair, complexion, shape of skull, facial angle, facial bones, shape of eyes, nose, mouth, proportionate length of extremities, mental qualities, and the like); miscegenation; origin and evolution of human speech, and its value as a test of race; stock races and languages; mixed races and languages; influence of the environment on the evolution of human varieties, on their pursuits, temperament, religious views, social status; origin of the human family, of the tribe and nation. These questions cannot here be discussed in detail; but it may be stated in a general way that the monogenist view, which derives mankind from a single pair, is now generally accepted by sound ethnologists, both as inherently more probable than the polygenist doctrine of several independent centres of evolution, and also as sufficient to account for the actual conditions. Monogenism, which has such an important bearing on the whole study of man, is based, not on scriptural authority, but on the solid ground that all existing divisions of mankind are fruitful among themselves, and otherwise present such close physical and mental qualities as are best explained by their descent from a common ancestry. Viewed in this light the subjects of discussion assume a totally different aspect; there are no longer any absolutely fundamental divisions of mankind; all are connected by their common genetic descent, and such terms as race, type, stock, acquire a purely relative sense. The *genus homo* is replaced by the *species humana*, which branches off into an indefinite number of *varieties*, but which nevertheless presents a few marked types, which it is still convenient for purposes of classification to distinguish and to regard as practically fundamental. Blumenbach (1752-1840), who may be regarded as the founder of systematic ethnology, recognised five such

fundamental types: Caucasian, Mongolic, Ethiopic (Negro), American, and Malay, including in the last the Polynesian and Australian. Since then various other schemes of classification have been proposed with a general tendency to diminish the main divisions, which by the best living anthropologists are now reduced to three: *Ethiopic* or *Negro*, chiefly in Central and South Africa, Oceania, the West Indies, and the Southern United States, numbering altogether about 230,000,000; *Mongolic* or *Yellow*, including Blumenbach's Malay and American, chiefly in North, Central and South-East Asia, the Eastern Archipelago, Polynesia, and America, numbering 650,000,000; *Caucasic* or *White*, nearly all Europe, South and South-West Asia, North Africa, North America, the southern extremity of Africa, and Australasia, numbering over 700,000,000. (For the physical and mental characteristics of these fundamental groups and other details, see CAUCASIC, MONGOLIC, and NEGRO RACES.) Here the chief point to attend to is the vast antiquity of man, dating certainly from quaternary times, which, combined with his migratory and predatory habits, has resulted in endless interminglings and a consequent partial obliteration of the primordial types. Hence there are scarcely any, if any, absolutely pure or unmixed races; the ideals have long disappeared, and the scientific ethnologist recognises, not so much any sharply defined Negro, Mongolic, or Caucasian divisions, as certain Negroid, Mongoloid, or Caucasoid groups, between which it is seldom possible to draw any hard-and-fast lines. As the process of miscegenation is still going on, the tendency is to still greater effacement of racial distinctions, and, in fact, to a reversion to the primordial unity or, at least, to a substantial uniformity of type, effected partly by interminglings, partly by the elimination of the lower elements incapable of assimilation. But the environment has to be reckoned with; and while miscegenation tends to uniformity, climate, soil, relief of the land, food, pursuits, and other outward influences will "redress the balance" and have the effect of maintaining and even intensifying the physical and mental differences now existing between the various divisions of mankind.

Ethyl. [ETHANE.]

Ethylamine, $C_2H_5NH_2$, is a colourless inflammable liquid which may be regarded as ammonia (NH_3), in which one atom of hydrogen has been replaced by the radical *Ethyl* (C_2H_5). It is present in the distillation product of beet-sugar molasses, and may be artificially prepared by very many methods, *e.g.* by heating ammonia and ethyl chloride,



It is very soluble in water, and the solution is very strongly alkaline. It has a strong odour like that of ammonia, which it closely resembles in all its properties, but behaves as a stronger base. By replacement of the remaining hydrogens of the ammonia by ethyl, *diethylamine* (C_2H_5)₂NH and *triethylamine* (C_2H_5)₃N may be obtained.

Ethylene, C_2H_4 , is the first of the series of hydrocarbons known as the *olefines* (q.v.), all of

which can be represented by the general formula C_nH_{2n} . It is a colourless gas slightly soluble in water and alcohol. It is inflammable, burning with a luminous flame. It is formed by destructive distillation of wood and most organic bodies, and is hence found in coal-gas, of which it is the principal illuminating constituent. In may be most readily prepared by distilling a mixture of alcohol and concentrated sulphuric acid. It can be liquefied by great cold and pressure, and by its rapid evaporation very low temperatures can be obtained. Large quantities of liquid ethylene were thus used in the preparation of liquid oxygen. It readily forms addition products, and is hence said to be *unsaturated*. With chlorine it forms an oily liquid (Ethylene Chloride, $C_2H_4Cl_2$) known as Dutch liquid, owing to which it received formerly the name olefiant gas.

EtioIation (from the French *etioIer*, to blanch), the bleaching of leaves by the imperfect development of chlorophyll, either from the exclusion of light, the absence of iron or other mal-nutrition. It is often accompanied by the non-development of poisonous principles, as in the artificial blanching of celery.

Etive, **LOCIT**, in the Lorne district of the county of Argyre, Scotland, is an inlet of the sea upon the west coast, of varying breadth, but nowhere more than $1\frac{1}{2}$ miles wide, and extending for 20 miles inland. It has beautiful scenery, and there are several creeks which afford good anchorage to vessels. Not far from the entrance is a rapid caused by a ridge of rocks, and at certain states of tide this is a cataract.

Etna (now locally called Monte Gibello) is a lofty volcanic mountain of Sicily, in the province of Catania, on the east coast. Although it has the appearance of being isolated, it is in reality connected by a ridge with the general mountain system which runs from east to west along the northern coast of the mountain, and is a continuation of the Italian chain. The ancients fabled it as the prison of Enceladus and Python, and also as the workshop of Vulcan and the Cyclopes, whose labours and restlessness gave rise to the volcanic manifestations and earthquakes. The first recorded eruption took place in the time of Pythagoras, since when there have been very many at varying intervals, and the volcano was in eruption in July, 1892, to the great dread of the province, which has often suffered severely from both eruptions and earthquakes. The crater at the top has often changed its place. The mount, from the point of view of climate, may be divided into three belts, the lowest of which is very fertile. The middle belt used to be covered with fine forests of beech, chestnut, oak, and pine; and the highest region is almost desert, and is covered for great part of the year with snow. The summit is at a height of 10,960 feet.

Eton, a town in the county of Buckingham, on the left bank of the Thames, which separates it from Windsor, the two towns being united by an iron bridge. Eton College, one of the chief public

schools of England, was founded by Henry VI. in 1440, and dedicated to the Blessed Virgin. Besides the college, which has a Provost and fellows and seventy scholars, there is a varying number—generally about 900—of Oppidians ("town-boys"), as the pupils not on the foundation are called. The scholars are lodged in college, but the Oppidians are distributed among boarding houses kept by masters, "dames," or others, in various parts of the town. Candidates for scholarships must be between 12 and 15 years of age, while Oppidians are admitted between the ages of 10 and 14. There are scholarships and exhibitions to Oxford and Cambridge. The college, parts of which date from the years immediately following the foundation, is chiefly Perpendicular, but additions are constantly being made according to the requirements of modern education. The older buildings consist of two quadrangles, containing chapel, upper and lower schools, masters' rooms, provost's lodge, fellows' apartments, and library. Till comparatively recent times the curriculum was entirely classical, but now the ordinary subjects of a liberal education are also admitted. The playing fields of Eton are famous, and its cricketers often win renown afterwards at Oxford or Cambridge and elsewhere, while the facilities for boating on the Thames make the Etonian oarsmen valuable recruits for College and University eights. There is also a numerous cadet corps, which forms a battalion of itself. The old custom of *Eton Montem* has been abolished. [MONTEM.] Pop. (1901), 3,293.

Etruria, the ancient name of the country in Italy lying to the W. of the Apennines and the Tiber. This was Etruria proper, though at a certain period of prosperity the Etruscans held the valley of the Po and part of the region south of the Tiber. Central Etruria consisted of a confederation of twelve cities, and one of these cities, whose remains show that it must have contained a vast population and have reached a high state of civilisation, was for centuries the great rival and deadly foe of Rome. The early history of Rome is mixed up with that of Etruria: the Tarquins were an Etruscan family who gained the upper hand in Rome, and were driven from it by a revolt, and Lars Porsena of Clusium was perhaps no more a single personage than Pharaoh of Egypt, since the name seems to have designated an office. Throughout the country vast cemeteries, the remains of Cyclopean walls, countless inscriptions in archaic language, and often indecipherable, richly decorated tombs, and mural paintings, bear witness to a civilisation compared with which that of Rome was infantine. The Etruscan civilisation was centuries earlier than that of Rome, and when history, as distinct from legend, begins, Etruria was a great naval power fit to ally itself with Carthage, and Rome was to a great extent an Etruscan city, deriving much of its religion, social customs, and greatness from that source. Hiero of Syracuse fought with and defeated an Etruscan fleet off Cumæ in 525 B.C. The death-blow to Etruria as a separate power seems to have been given by the irruption of the Gauls

under Brennus, and from that time they gradually yielded to the supremacy of Rome.

Etruscans, one of the cultured nations of antiquity, who were the dominant people of Italy before their overthrow by the Romans (280 B.C.). Their chief seat was the valley of the Arno, and thence south to the Tiber; but they had also reached the Adriatic slope, where they held the cities of Adria, Ravenna, Felsina (Bologna), and Mantua. On the west side, where their southernmost stronghold was the island of Capri, they had established a confederacy of twelve towns in Campania, while their navies or piratical fleets swept the Tyrrhenian Sea, named from them. The Etruscans, who called themselves Rasena, were known to the Greeks as Tyrrheni (Tyrseni) from a mythical leader, under whom they were fabled to have reached Italy from Lydia (Asia Minor), though more trustworthy tradition brought them over the Alps through Rhoetia down to the valley of the Po. But the



ETRUSCAN VASES.

origin of the Etrusci or Tusci, as the Romans called them, is still wrapped in deep obscurity, and has given rise to endless discussion amongst ethnologists and philologists, some regarding them as Italic or Celtic Aryans, others affiliating them to the Semites or to the "Turanian" (Mongolo-Tatar) stock, while Brinton has recently, on shadowy grounds, proposed a Libyan (Berber) connection. Unfortunately their language, which survives only in numerous short sepulchral and other inscriptions and in one long document lately found enveloping an Egyptian mummy, has failed to solve this difficult question, the structure and affinities of the language itself being even more angrily discussed than the origin of the people. Sir W. Betham freely interpreted the Etruscan texts through the medium of the Irish (Celtic), of which he had little knowledge; Corssen explains them by means of the Italic, regarding Etruscan as fundamentally connected with Latin, Umbrian, Oscan, and the other members of that family; lastly, Robert Brown and many others have, with some show of success, expounded these inscriptions by the aid of the

Finno-Tataric group, of which they consider Etruscan to be undoubtedly a distinct branch. Yet the Etruscan physical type, as preserved on the cinerary vases and even still surviving amongst some of the modern Tuscan peasantry, is neither Italic, nor Celtic, nor yet Mongolic, as postulated by these theories based on doubtful linguistic evidence. The Etruscans, who under Hellenic influence developed a characteristic school of art, appear to have been a short, thick-set race, inclined to obesity, with broad shoulders, arched nose, broad receding forehead, kinky hair, dark or swarthy complexion, and dolichocephalic (long) head. Their artistic sense seems to have permeated all classes, and may still be studied in their numerous sepulchral monuments, painted vaults, bas-reliefs, bronzes, candelabra, fictile vases and pottery of all kinds, gems, fibulae, bracelets, and other ornaments. From the Etruscans the Romans received their first lessons both in art and in such religious practices as divination and sacrificial offerings. The *Cloaca Maxima*, the oldest extant monument in Rome, was built by them, as were also the Mamertine Prison and the walls attributed to Servius Tullius. Even the bronze wolf preserved in the museum on the Capitoline Hill, and associated with the earliest Roman legends, is said to be the work of an Etruscan artificer; but the Etruscans nowhere succeeded in developing a great military power—their scattered colonies forming so many independent kingships or republics unconnected by any strong political ties. The Gauls had little difficulty in overrunning Etruria in 590 B.C., and three centuries later it fell an easy prey to the conquering Romans, who rapidly destroyed Etruscan culture and the national records, though the Etruscan language still survived in some rural districts down to the time of Augustus and Claudius. It was written usually from right to left in a great variety of characters, all, however, based on the archaic Cadmean alphabet introduced at a remote epoch by the Greeks into Italy. A literature in the ordinary sense of the term seems to have never been developed, and to this, combined with the iconoclastic spirit of the Roman conquerors, is mainly due the sudden extinction of Etruscan civilisation. (Lanzi, *Saggio della Lingua Etrusca*, Rome, 1789; Corssen, *Ueber die Sprache der Etrusker*, Leipzig, 1874; Conestabile, *Iscrizioni Etrusche*, etc., Florence, 1858; Robert Brown, jun., *Etruscan Studies*, in the *Academy*, 1886-92, *passim*.)

Etty, WILLIAM (1787-1849), an English painter, born at York, where also he died. For seven years he was apprenticed to a printer at Hull, but in 1807 he came to London, entered the Royal Academy as a student, and studied under Sir Thomas Lawrence. His early efforts were refused at the exhibitions, his colouring being considered good, but his designs feeble, and it was not till after a visit to Italy that he achieved some success with his *Pandora* and his *Coral Finders* in 1820, which was followed up the next year by his *Cleopatra Arriving in Cilicia*. His *Pandora Crowned by the Seasons* caused him to be elected A.R.A. in 1824. From this time his progress was constant,

and he became renowned as a colourist, and for his representation of the nude. Of his many works, *Ulysses and the Syrens*, *Youth at the Prom and Pleasure at the Helm*, and *Woman Pleading for the Vanquished*, are well known.

Etymology (Gk. *etumos*, true), a term used in philology to imply the true original sense of a word, or "the tracing out and describing the elements of a word with the modifications of form and sense." In a secondary sense it denotes the branch of philology which is connected with this. The discovery of Grimm's Law and a rigid scientific method of research have made a revolution in the science of etymology, which till comparatively late years was wildly fanciful. In grammar, etymology is that part which deals with letters and the parts of speech separately.

Eubœa (modern *Negropont*; Turkish *Egripo*), an island of the *Ægean Sea*, opposite to *Boeotia*, *Thessaly*, and *Attica*, being separated from the mainland by the *Euripus*, the channel of which is at *Chalcis* or *Negropont* (the capital) only 120 feet across, and is crossed by a bridge partly supported by a rock in the middle of the channel. (It is now being widened by the Greek Government.) There is much trace of volcanic action and the formation is principally slate or calcareous. There are two mountain chains, one of which in the north extends to *Cape Sunium*; and the highest point is *Delphi* in the centre (5,725 feet). The island is wonderfully fertile and salubrious, and there are extensive woods of pines, firs, chestnuts, and planes on the mountain sides. Much of the cultivation is carried on by English and French farmers.

Eucalyptus, a large genus of trees belonging to the myrtle family, natives of Australia or Tasmania, a few species occurring as far north as Timor and the Moluccas. Many of them grow to an immense size, and, though rapid in growth, yield dense and valuable timber. *E. amygdalina*, the peppermint-tree, reaches 480 feet in height, or 150 feet more than the tallest *Sequoia* (q.v.), and 100 feet in girth; and other species approach these dimensions. Some are known as *Iron-barks*, others as *Stringy-barks*, whilst from their resinous exudations the whole genus are known as *Gum-trees*. The leaves are entire; leathery; studded with glands containing fragrant volatile oils; at first opposite and horizontal, afterwards scattered and vertical; and so varying in form at different ages as to have led to considerable confusion in the discrimination of species. The flowers are axillary, and either solitary or in clusters. The superior calyx is woody, and its upper half falls off as a cap as the flower opens, carrying the corolla with it. The stamens and the seeds are indefinite in number. As timber, *E. globulus*, the blue gum; *E. gigantea*, the stringy-bark; *E. amygdalina*, the peppermint-tree; *E. resinifera*, the iron-wood; and the tewart and jarrah, *E. gonicalyx* and *E. marginata* of West Australia, seem the most valuable. *E. rostrata*, *corymbosa*, and *citriodora*, with other species, yield the useful astringent Australian kino (q.v.); *E. Gunni*, the cider-tree of Tasmania, gives a refreshing sap in spring; and *E. mannifera*,

E. viminalis, and others, exude a saccharine manna (q.v.). Volatile oils have been distilled from the leaves of many species. That known as eucalyptus oil, used in soap-making and as an adulterant of attar of roses and oil of neroli, is now largely manufactured in Australia, mainly from *E. amygdalina* and *E. citriodora*. It is thin, pale yellow, and pungent, resembling oil of lemon. *E. hæmas-toma*, of Queensland, yields an oil intermediate between those of geranium and peppermint, and *E. Staigeriana* 2 to 3 per cent. of one closely similar to oil of verben. Mallee oil, that of *E. oleosa*, is a useful solvent for copal, resembling cajeput. Eucalyptus leaves are smoked to relieve asthma and bronchitis; and the warm aromatic tincture prepared from them, which resembles cubebs (q.v.) in its bitter taste, though inferior to quinine in fever, is a powerful diaphoretic increasing the heart's action. Since 1854 the blue gum, *E. globulus*, so called from its glaucous leaves and young stems, has been successfully introduced into the Roman Campagna and elsewhere in Southern Europe—into Algeria, Egypt, Natal, India, California, and other countries with miasmatic swamps, scant supplies of firewood, or climates liable to drought. Its action on miasma is probably merely the drainage effected by its roots. It seems to thrive anywhere where the mean annual temperature is not less than 60° F., but cannot survive a temperature below 27° F.

Eucalyptus Oil, the essential oil obtained from *Eucalyptus globulus*. It is a pale yellow liquid, with a peculiar odour. It has a specific gravity .93, and gives many products by distillation. It appears to consist of a substance *eucalyptol*, $C_{10}H_{18}O$, together with hydrocarbons allied to the terpenes.

Euchlorine, a yellow gas which is evolved when potassium chlorate is acted upon by hydrochloric acid. Faraday believed it to be a definite oxide of chlorine, but it has been shown that it really consists of a varying mixture of chlorine and chlorine peroxide (ClO_2). It has powerful oxidising properties, and is much used for disinfecting, etc.

Euchre (possibly from a Spanish word) is the name of a game of cards played chiefly in America. It is played by two, three, or four people, and the pack consists of 32 cards, those from 2 to 6 inclusive being thrown out. The chief cards are the Right Bower (Germ. *bauer*, peasant), which is the knave of trumps, and the Left Bower, which is the other knave of the same colour, the remaining cards being valued as in whist. A player has the option of playing or passing; if he plays and gets a minority of the tricks (which are five in number), he is euchred, and his opponent scores 2. Generally the gainer of 5 tricks scores 2, of 3 tricks 1. The cards must be dealt 3 and 2. There are modifications of the game, such as French Euchre, in which there are 24 cards, and Railroad Euchre, where there is an extra card.

Euclid. 1. Of Megara, one of the founders of the Megarian school of philosophy (about 400 B.C.). His doctrines probably influenced those of Plato.

2. A famous geometrician who lived and taught in Alexandria at about 300 B.C., in the time of Ptolemy I. Besides his *Elements* he wrote the *Phenomena*, on astronomy, and the *Data*, a collection of geometrical theorems, and possibly also various books on Harmony, Optics, etc. Euclid's *Elements* have been used as a text-book for centuries, though abroad various systems of modern geometry have taken its place. It is in thirteen books; the first four are on plane geometry involving only figures built up of straight lines and circles; the fifth is on proportion generally; the sixth on proportion as applied to similar plane figures; the seventh, eighth, and ninth are on numbers; the tenth on incommensurable quantities; and the last three on solid geometry. The first printed edition of the *Elements* was published at Venice in 1482. The only full edition is that of Gregory, published at Oxford in 1703.

Eudiometer, a glass vessel, largely used in gas analysis. Various forms of eudiometers exist, many specially adapted for some particular analysis. The most common form consists of a straight tube of thick glass open below and closed above, upon which is accurately engraved a scale, generally in millimetres. Through the glass near the top are sealed two platinum wires across which an electric spark can be passed. The mode of use consists in placing a known quantity of gas into the eudiometer over mercury, then adding an amount of oxygen (other gas if necessary) and exploding. From the diminution in volume (and further diminution by action of different absorbents if necessary) the quantity of hydrogen or other detonating gas is known.

Eudoxia, an empress of the 5th century, wife of Arcadius, and mother of Theodosius II. She was the beautiful daughter of a Frank general at Byzantium, and a courtier named Eutropius caused her to be selected by Arcadius by leaving her portrait, as if accidentally, in the Emperor's way. Eutropius afterwards presumed upon his power to threaten her if she thwarted his views, and she in consequence brought about his ruin. She was also a great enemy of St. John Chrysostom, who used to compare her with Jezebel and Herodias, and in the struggle between his partisans and hers St. Sophia was burnt and half Constantinople. She was in many respects not unlike Theodora. Her death took place in 404.

Euechinoidea, the name of the sub-class of Echinoidea (q.v.) including all the Echinoids which have lived in and since Jurassic times, with some few representatives in earlier seas. The sub-class, though accepted for convenience, cannot be distinguished from the earlier "Palæchinoidea" by any satisfactory definition.

Eugène François, commonly known as Prince Eugène (1663-1736), a celebrated Austrian general and statesman, was born at Paris, his father being Eugène, Duke of Savoy, and his mother a niece of Cardinal Mazarin. He was intended for the Church, but his inclination was towards arms, and he applied in vain to Louis XIV. for his commission,

his application being opposed by Louvois, who hated the family. He then entered the Austrian army, and for his good service against the Turks was made colonel. His conduct at the siege of Belgrade (1688) and at Mayence (1689) gained him still further promotion. When war broke out between France and Austria he was sent into Piedmont, and gained the rank of field-marshal; and at the end of the war went to Hungary as commander-in-chief against the Turks, whom he forced into the treaty of Carlowitz (1699). In the Spanish War of Succession he was commander-in-chief in Italy, and defeated Villeroy at Cremona in 1702. He then commanded the army in Germany, and as head of the Council of War co-operated with Marlborough in gaining the battle of Blenheim in 1704. In 1705 he was again commanding in Italy, and after losing a battle in which he was wounded, he drove the French out of that country. Entering France, he laid siege unsuccessfully to Toulon, and in 1708 and 1709 was engaged with Marlborough in the victories of Oudenarde and Malplaquet. The recall of Marlborough prevented his doing anything more decisive, and after the end of the war he was employed against the Turks, and took Belgrade in 1717 after gaining three victories. He then for 15 years of peace distinguished himself as a statesman, till fresh wars brought him into the field as head of the army of the Rhine, but he did nothing of importance, perhaps in consequence of his advanced age.

Eugeniocrinidae, a family of Crinoids, characteristic of the Jurassic rocks of the Continent; they were small forms fixed by a short stem, and with the basal ring of plates quite rudimentary.

Eugénie, MARIE DE MONTIJO DE GUZMAN, was born in Andalusia in 1826. Her father was a Napoleonist, and her mother was of an old Scottish family. She lived in different capitals of Europe, and at Paris her horsemanship and her constant attendance at Court fêtes attracted the attention of Napoleon III., who married her in 1853. In the early part of the Empire she was popular for her kindness and her benevolence, and had great influence in State Councils. After the downfall of the Empire she escaped to England, thus avoiding the risk of meeting the same fate as Marie Antoinette, which she is said to have feared. The death of her husband, and the tragic fate of her only son in Zululand, and her friendship with Queen Victoria, have caused Englishmen to look upon her as almost a fellow-countrywoman.

Eugenius, the name of four popes—i.e. Eugenius I. (654-657); II. (824-827); III. (1145-1153); IV. (1431-1447).

Eugenius, ST., Bishop of Carthage in the latter part of the 5th century. He was twice banished owing to his antagonism to the Arian Vandals, on the second occasion founding a monastery at Vienne, in France, where he died (505). There is a profession of faith which bears his name. His feast is on the 13th July.

Euglena, a small Infusorian, with a short and usually green body; it has a long, vibratile filament.

or flagellum, at the base of which is an eye spot. The members of this genus swarm in stagnant pools of fresh water in such abundance as to discolour it.

Euhemerism (from EUHEMERUS, a Sicilian and Cyrenaic philosopher of the 4th century B.C.), a system of explaining the ancient myths of the Greek gods by looking at them all as deified heroes, whose real deeds viewed through the mist of time became distorted and exaggerated. Euhemerus himself had a vivid imagination, and was looked on as a great liar. The tracing of the religious sentiment to totemism and ancestor worship is a kind of Euhemerism.

Eulenspiegel, or ULENSPIEGEL, TYLL, a well-known character in German, Netherland, and Flemish folk-lore, who is supposed to have existed in the 13th century, is claimed as a native of Germany, and is variously reported to have been buried at Mölln in Germany and at Damme in Flanders. The life of him sets forth his many Puck-like tricks, but his adventures, though amusing, are somewhat too coarse for modern taste. His history existed known in Hoch-Deutsch and in Platt-Deutsch, in the early part of the 16th century, and his doings have been translated into many languages. His name, literally translated, appears in English as (H)owleglas, under which title he is the subject of a miracle-play. There is a modern English edition.

Euler, LEONARD (1707-1783), a distinguished mathematician, who was born at Basel, and educated, first by his father, who was a clergyman, and then at the university under John Bernouilli. When 19 he was *proximo accessit* in a treatise on masting of vessels, invited by the Paris Academy of Sciences. Through his friends the Bernouillis he was called on to constitute the mathematical department in the St. Petersburg Academy, founded by Catherine I., and many hundred papers and dissertations are the proofs of his industry while there. For about twenty-five years from 1741 he was professor of mathematics at Berlin University, but the last sixteen years of his life were passed at St. Petersburg. He was a great advancer of the analytic method, which he applied also to mechanics, and he had a great share in the invention of achromatic telescopes. He also attempted to construct a theory of the tides, and wrote upon metaphysical and philosophical subjects. Among his many works are treatises on the Integral and the Differential Calculus, and an introduction to Algebra.

Eumenides, also called ERINYES, the name given to the Three Furies—Alecto, Megæra, and Tisiphone. The name of Eumenides, or "Well-wishers," was given to avoid offending them, in the same way that the Fairies are called the Good People; while that of Erinyes has no Greek signification, but is said to be traceable from Sanskrit. They were the avengers of blood, and as such are commemorated by Æschylus in the *Eumenides*. Probably the conflict there depicted

between them and Apollo indicates the introduction into Athens of a new worship displacing the matriarchate by male kingship.

Eunomius, an ecclesiastic of the 4th century, was born at Dacora, in Cappadocia. He went to Alexandria, and became the pupil of Ætius, and was Bishop of Cyzicus in 360. His Arian views soon led to his resignation, and he was sent to Cappadocia. His views, which were adopted by a sect called after him, were condemned by two Œcumenical Councils. Two apologies and a confession of his are extant.

Eunuch (Gk. *eunē*, a bed, and *ēchēin*, to hold) is literally a guard or groom of the chamber, but the name is generally applied to the castrated attendants in an Eastern harem. The custom of employing such attendants is of great antiquity. Singers have sometimes been made eunuchs in order to retain their soprano voices, but this barbarous custom is now a thing of the past with regard to the stage.

Euomphalus, an important extinct genus of Gastropoda which ranged from the Lower Silurian to the Trias, and occurred in Europe, America, and Australia. The typical species, *E. pentagonalis*, is a characteristic fossil of the Carboniferous Limestone.

Euonymus, a genus of shrubs and small trees belonging to the order *Celastraceæ*. *E. europæus*, the only British species, has tough, yellowish wood, formerly used for skewers, shoe-pegs, and spindles, whence the plant is known as Spindle-tree. It has glossy leaves and greenish flowers, which are succeeded by bright rose-pink capsules, which on bursting disclose the seeds, each covered with an orange aril. Tennyson therefore speaks of it as "the fruit which in our winter woodland looks a flower." Leaves, flowers, and fruit are poisonous. A good crayon charcoal is made from the wood. *E. japonicus*, an evergreen shrub, with dark ovate leaves, is much cultivated in London, but thrives specially on our south coast. *E. sieboldianus*, the Pai'cha of China, is a substitute for boxwood introduced in 1878.

Eupatoria, a Russian port on the Black Sea, 40 miles N.W. of Simferopol, and in the government of Taurida. It was formerly a town of the Crim Tartars. At the beginning of the Crimean War the allied forces landed here, and the Russians failed in an attack upon it in February, 1855.

Euphemism (Gk. *eu*, well; *phēmi*, I speak)—to speak well of, to speak fair—that figure of speech in which something is called by a fair name instead of a disagreeable or uncomplimentary one. The Greeks called the stormy Black Sea the Euxine ("kind to strangers"), the Furies the Eumenides ("well-wishers"); so the Scots will call the fairies the Good People.

Euphorbiaceæ, the fourth largest natural order of Dicotyledonous plants, comprising over 3,000 species in over 200 genera. Having diclinous

flowers which are usually monochlamydeous, the order is classed among the Incomplete. Though half its species belong to tropical America, the genus *Euphorbia* contains 700 species, many belonging to Africa, and others scattered over nearly the whole world. They vary immensely in size and habit from large trees to tiny herbs; but almost all agree in having a milky, acrid, poisonous juice. Their leaves are generally scattered, simple and stipulate, and their flowers typically pentamerous. The stamens may be indefinite in number and free, monadelphous or polyadelphous. The ovary is superior, and generally composed of three carpels, which separate more or less elastically from a central carpophore, and contain one or two seeds, which are pendulous, albuminous, and often arillate. The genus *Euphorbia* is singularly varied in habit, some African species being 30 to 40 feet high and 2 feet in diameter, and others succulent and angular, with their leaves reduced to spines so as to closely resemble the Cactaceæ (q.v.), whilst our British species are mostly mere weeds with foliage often of a vivid green. All agree, however, in the character of their inflorescence. This is surrounded by a cup-like involucre or "cyathium," with four or five marginal lobes alternating with glandular structures. Within this cup are several male flowers and one female one in the centre. The former each consist of a single stamen, the junction of its filament with its pedicel suggesting an articulated filament. The female flower is also pedicellate, hanging over the edge of the cyathium, and none of the flowers have any perianth. *Euphorbia resinifera*, a native of the Barbary States, yields on incision the acrid resin known as *Gum Euphorbium*, formerly used medicinally; *E. Cattimandoo*, of Madras, yields the caoutchouc *Cattimandoo*; and *E. Drummondii*, the alkaloid *Drumaine*, which has anæsthetic properties like those of cocaine. The poisonous properties of most members of the order are more or less dissipated by heat, so that many are used as food. Of these the most important is the Manioc (*Manihot*), the source of cassava (q.v.) and tapioca. Other valuable plants belonging to this order are the various species of *Hevea* yielding the caoutchouc of Brazil; *Ricinus communis* yielding castor oil (q.v.); *Oroton Tiglium*, from which croton oil (q.v.), and *C. Eleuteria*, from which Cascarella bark (q.v.) is obtained. From *Aleurites triloba*, candle-nut, country walnut, or kekune oil is obtained in the Fiji and Sandwich Islands, and *Stillingia sebifera* is the Chinese tallow-tree. *Crotophora tinctoria*, the "turnsole" of the Mediterranean region, and *Mallotus philippinensis*, "kamala" or "wars," yield dyes; *Hura crepitans* has a large woody fruit, which, though singularly explosive, can be prepared as a sand-box, whence the tree takes its name; and the box-wood (q.v.), *Buxus sempervirens* is so closely related to the order as generally to be classified with it.

Euphrates, a river of Western Asia, which, with the Tigris, encloses the fertile region known in Scriptural history as Mesopotamia, the river formed by the junction of the Euphrates and Tigris falling into the Persian Gulf, 60 miles below Basra, after a

course of 1,700 miles, 1,200 of which are navigable for light vessels, and 120 for war vessels. Babylon and Nineveh were both in the Euphrates region, which was kept fertile by an elaborate system of irrigation. Attention has of late years been drawn to the valley as a likely route to India, either by improving the navigation, or by construction of a railway, or by a union of the two plans, but political considerations have prevented any practical result.

Euphuism, literally the imitating of Euphuus. This was the part title of a book, or rather books, written by Lyly in the latter part of the 16th century. The language was high-flown, and the sentiments exaggerated and fantastic, but the books became the models of court speech. Scott, in the *Monastery*, tries to show us what it may have been like in the mouth of a courtier, as does also Kingsley in *Westward Ho*.

Euplectella, a genus of Siliceous sponges, including the Venus's flower-basket (q.v.).

Eupsammidæ, a family of Perforate corals including the majority of that group. Some genera, such as *Stephanophyllia*, have affinities with the *Fungidæ* (q.v.). The family first becomes important in the Cretaceous, but one genus (*Calostylis*) from the Silurian has been assigned to it.

Eurasians (i.e. "European Asians") a term commonly applied to the half-caste Europeans and natives of India and other parts of Asia. The most numerous and the most degraded are the Portuguese half-castes of Goa, Diu, Ceylon, the Malay Peninsula, Timor, and Macao, who are often scarcely distinguishable from the surrounding populations. In Malacca they are known as *Sirani*—i.e. "Christians"—and all are still nominally Roman Catholics. The British Eurasians of India are generally superior in physique, energy, and intelligence to the Hindus, but have the reputation of being crafty, if not dishonest, and are treated almost as outcasts both by Europeans and natives. In recent years a fine race of Eurasians has sprung up in Indo-China by crossings between the French and Annamese. They are numerous, especially in Lower Cochinchina, where many possess the best physical and moral qualities of both races.

Eure, a department and also a river of France. The river, which gives its name to two departments, rises in the department of the Orne, flows through the departments called after it, and falls into the Seine near Pont de l'Arche. For half its course of 124 miles it is navigable. The department is to the E. of Calvados, and has an area of 2,300 square miles. It consists, for the most part, of a succession of flat plains watered by many streams, which all eventually flow into the Seine estuary, which forms a portion of the N.W. boundary of the department. The climate is humid, variable, and temperate, and well fitted for the growth of plums, cherries, and pears. The vine is plentiful, but little wine is made. Hemp and flax are grown, and the district is noted for cattle- and horse-rearing. Game and fish also abound. The mineral productions are important, and the copper, iron, and zinc works

employ 50,000 people. There are also quarries, and fuller's earth and potter's clay are produced. The manufactures are varied and extensive, one of the productions being a fine woollen cloth. The principal exports are cider, perry, cattle, horses, and the products of the different manufactures. The capital is Evreux (q.v.).

Eure-et-Loir, a French department lying next to that of Eure, and having an area of 2,267 square miles. It is mostly a large plateau, which in the W. is diversified by valleys and streams. A ridge running from S.E. to N.W. makes the principal watershed, the northern basin of which has the Eure, which flows into the Seine, and the southern the Loir, which flows into the Sarthe 13 miles above its junction with the Loire. There are tributaries of each of these rivers, and there are also small lakes. The land produces good wheat, and there are numerous water-meadows. Many apples are grown for cider, and vines are abundant, but produce inferior wine. Game abounds, and poultry are reared for the Paris market. There is some iron, but it is little worked; and there are few manufactures, the department being chiefly agricultural. The capital is Chartres.

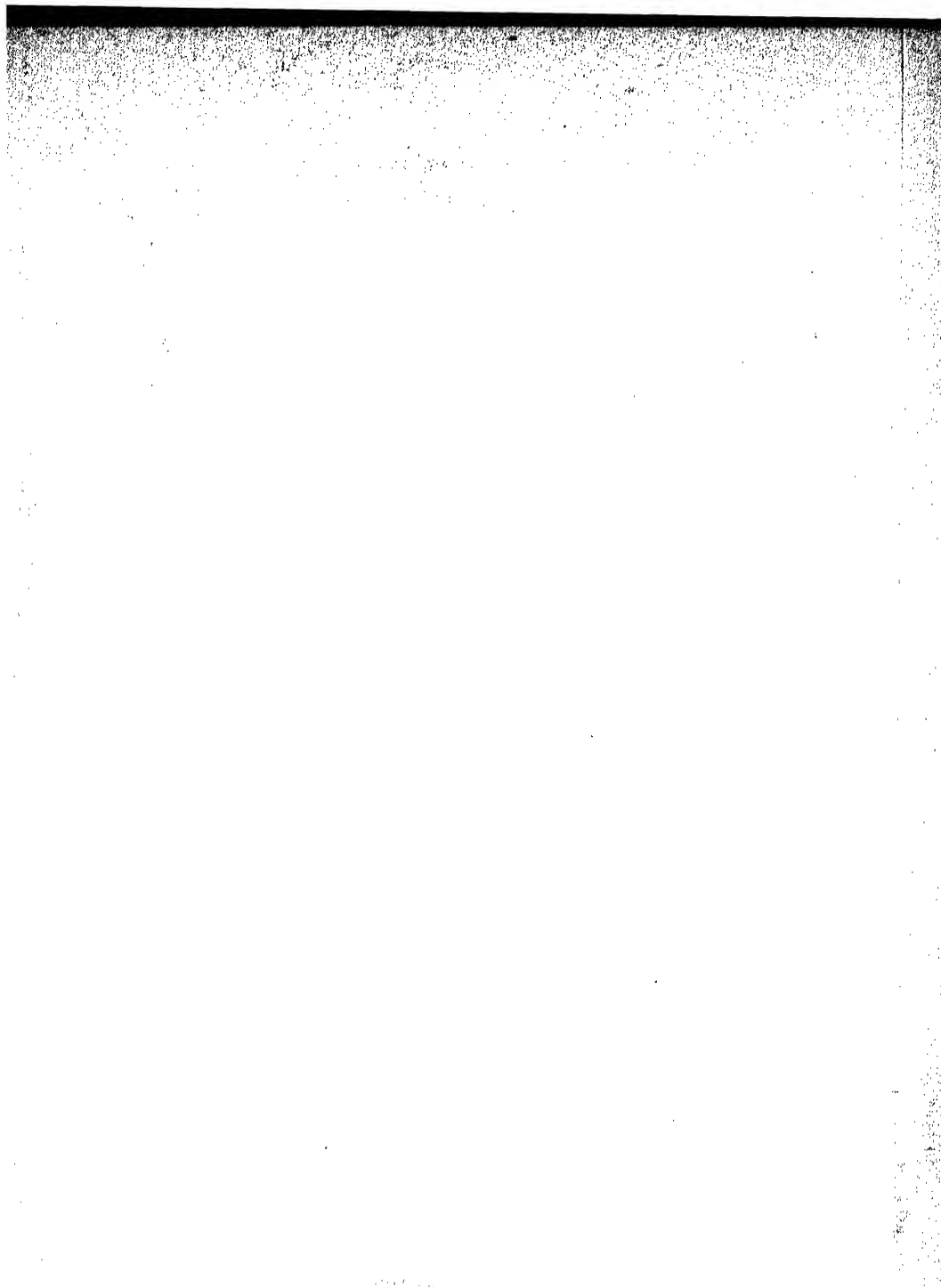
Euripides (480-406 B.C.), an Athenian poet, said to have been born at Salamis on the day of the defeat there of the Persian fleet, though other accounts put his birth at an earlier or later date. He began by studying painting, and then rhetoric under Prodicus, and philosophy under Anaxagoras. He is said to have composed tragedies at 18, and to have brought them forward in public competition in 455, though it was not till 441 that he gained a first prize. *Orestes* was brought forward in 408. For some reason he left Athens, and went to the court of Archelaus, King of Macedonia, who had a great regard for him. Indeed, he seems to have had a higher reputation abroad than at home, if stories are to be believed that some Athenian prisoners found their lot much bettered through their being able to recite his works, and that a ship pursued by pirates was admitted to a harbour of refuge only through a similar power. The Athenians are said to have wished to have his dead body from Macedonia, but were unable to obtain it from Archelaus. A statue was, however, erected to him at Athens. Of his plays 18 are extant, and there are many editions of them. He abandoned the heroic and stormy style of Æschylus for one more fitted for the softer emotions, and the waning fortunes of Athens seem to have inspired him with a feeling of pathos. His handling of women has gained for him the reputation of a misogynist.

Europe is the smallest of the three continents of the Old World, and the smallest of all the five continents of the globe with the exception of Australasia. Its length from Cape Matapan, in latitude 35°, to North Cape, in latitude 72°, is 2,550 miles; and its breadth from Cape Clear, in Ireland, longitude 10° W., to the Ural Mountains, longitude about 60° E., is 1,900 miles. It is bounded on every side but the E. by the ocean. The Atlantic washes its western shores, the Mediterranean its southern,

while the semi-frozen Arctic Seas hem it in on the north. Only its eastern boundary is artificial, and, to some extent, indefinite. The generally accepted eastern boundary-line starts from the Bosphorus, follows the Euxine shore, then the Caucasus watershed, till it reaches the middle of the Caspian, when it trends in a north-easterly direction, and reaches the White Sea by a course roughly parallel with the Ural river and the Ural mountains. This somewhat hazy frontier has long formed one of the chief political dangers in Eastern Europe. The continent has sometimes been regarded as a peninsula of the neighbouring Asia, from which it is only separated at its south-east corner by the narrow Bosphorus, which bisects the isthmus connecting Europe and Asia. Indeed, all three may be regarded as parts of a single primeval continent.

Europe has an area of 3,800,000 square miles, and is divided unequally from east to west by lofty mountain ranges—a fact (as we shall see farther on) which has mainly shaped the course of its history. Southern Europe embraces three great peninsulas, Greece, Italy, and Spain, besides several large islands and numerous clusters of smaller ones. It is watered by the Mediterranean, the largest inland sea on the globe, being 2,000 miles in length and 600 miles in breadth. This great inland lake, with its secondary seas, affords easy access not only to the heart of Southern Europe, but to the northern coasts of Africa, and the south-western shores of Asia. Its deeply indented littoral has not only given salubrity to the climate, but afforded vast facilities also to inland and foreign commerce. To the north of the central mountain chain lies a widely different country. The northern half of Europe projects, as does the southern, several large peninsulas, the Scandinavian, consisting of Sweden and Norway; Denmark; and Russian Lapland, or Finland. A small part of Northern Europe lies within the Arctic circle, the rest being in the temperate zone.

The chief continental peninsula—Scandinavia—contains the principal mountain axis of Europe, which, commencing in the Pyrenees, continues through the Alps, and extends in a circuitous course through the mountains of Dalmatia, Albania, and Greece, right up to the west frontier of India. The Western Alps are the boundary of the two great basins which form together Western Europe. That south of the Alps, which stretches to the Atlas range in North-West Africa, contains the western section of the Mediterranean, whose depth may be judged from the fact that it has been sounded to 13,000 feet, only 2,780 less than the height of Mount Blanc. North of the Alps a much smaller, shallower, and entirely land basin is formed. Starting from the Alps near Geneva, it sweeps northward and then eastward to meet the spurs of the Alpine chain on the Danube. These two basins constitute the chief mountain regions of Europe. Beyond them lies the great plain of Northern Germany, 600 miles long, whose lowest depression is the shallow Baltic. In these mountain ranges lie the sources of all the great international rivers. None are found south of the Alps, owing to the short distance from the Mediterranean, which does not permit of



the accumulation of a sufficient body of water to form a river of the first magnitude. To the north of Europe we owe such streams as the Rhone, the Rhine, and the Danube; but Europe generally is richer in inland lakes and rivers than any other continent. The peninsular character of Europe contributes largely further to the salubrity of its general climate. The aerial currents from the Atlantic render arid deserts like those of Asia and Africa impossible, while the tempering breezes of the Mediterranean and its secondary seas make Southern Europe one of the paradises of the globe. Another striking advantage which Europe possesses is the uniformity of several of its most important productions. Wheat, for example, can be grown from Archangel to Sicily, and its soil will yield in abundance every cereal or fruit for which a tropical climate is not essential. Man, again, and nearly all of the fauna of Europe can live in any part of the continent which lies within the temperate zone. The sea-board of Europe is of enormous length compared with its area, extending 84,000 miles, and exceeding that of Africa, which is three times its size. The Mediterranean littoral alone measures about 13,000 miles. Geographically Europe is the garden of the world, and this fact alone may account for its long supremacy over other continents. It possesses, again, another geographical advantage not enjoyed by the rest. London is nearly the centre of the *land* hemisphere, and its proximity to the American continent has caused the very large emigration from Northern and Southern Europe to North and South America respectively. This is one main secret of the spread of European peoples over the fertile lands of the West.

The geological remains of the extinct fauna and flora of Europe show that before the glacial period it had a tropical climate, during which it seems certain that *man* existed on the continent.

The *population* of Europe is estimated at 390,000,000, or an average of 102 to the square mile—a ratio higher than that of any other continent. Though it produces the precious metals in smaller quantity than the other four continents, it is rich in carboniferous deposits, as also in iron, copper, lead, tin, and other useful metals.

The *physical configuration* of Europe (referred to above), divided as it is almost from E. to W. by lofty mountain ranges, shows how it must have been first settled in historic times. The southern or peninsular half, with its numerous islands and seas deeply indenting the land, was naturally the region to be first peopled. It possessed a genial climate and a fruitful soil. It was close to the ancient civilisations of Asia and Africa, which, like itself, formed part of the Mediterranean littoral, and which had been probably the cradle of the world's history. Northern Europe, on the other hand, was covered originally by dense forests and wide morasses over much of its surface, which made its climate less hospitable and its soil less fertile. It was isolated further from existing civilisations by a difficult mountain barrier—all which kept it in a state of barbarism for centuries after the great commonwealths of Greece had declined, and the

Roman Empire was approaching the zenith of its power. With one notable exception—Greece, whose high civilisation antedated by several centuries the dawn of the Roman Empire—that Empire is the pivot on which all European history turns. The barbarous tribes of the continent it subdued and absorbed first emerge from obscurity when Rome invaded their territories or they raided its borders; and their actual history as nations begins from the date of their final subjugation to the Roman arms. The kingdoms and republics of modern Europe all bear, again, more or less distinctly, the imprint of *Rome*.

The European races (with the exception of Turkey) all belong to the *Western* branch of the great Aryan family, whose earliest settlement has usually been located in Central Asia, at present peopled by its Eastern or Semitic branch. At some time both must have had a common language and *some* knowledge of the useful arts, as evidenced by the community of certain words in all European as well as Asiatic tongues, many of whose peoples can never have had any intercommunication. These Aryans spread over Europe in historic times in three great waves. The first occupied Greece and Italy, and are now known as *Celts*, dialects of whose language still survive in Wales, Ireland, and elsewhere. The second, known as *Teutons*, occupied Western Europe, and are the progenitors of the German and Scandinavian races, to the former of which we ourselves mainly belong. The third wave brought in the *Slavs*, who occupied that part of North-Eastern Europe known as the Balkan Peninsula, and are the progenitors of the Slavonic races. The chief exceptions to a pure Aryan occupation are (omitting Turkey, which is Semitic) the *Magyars* of Hungary, the *Basques* of the Pyrenees, and the *Fins* of Lapland.

For us the real *history* of Europe begins with Greece. It divides itself naturally into three periods:—(1) Pre-Roman, (2) Roman, (3) Teuton, or, in other words, *Greek*, *Roman*, and *Teuton*; and of these *ROME* is the great central point, to which all history before it looks forward, and all history after it looks back. European history, then, commences with Greece. Her story, whose beginnings are lost in fable and myth, is a marvellous one. Her political life forms to-day the model of the civilised world. Her statesmen, her orators, her poets, her philosophers, her historians, her sculptors, and even her generals, have had rivals, but no superiors. The Persians invaded Greek territory nearly 500 years B.C., and the Greek victory of *Marathon* over those barbarians ranks now as the first decisive battle of the world. Historians so famous as Herodotus, Thucydides, and Xenophon have immortalised the triumph of Greek arms in the long Persian and Peloponnesian wars. Alexander the Great, one of the central figures of the world's history, achieved the complete conquest of Persia after a campaign of only six years. He also subdued Tyre, and made Egypt the vassal of Greece, with other conquests never equalled in extent and importance, if not in duration, by any prince before or since. Greece must remain to all time the wonder of the world, displaying, as she did, on

no narrow a stage and in so brief a period, an exemplar which has, perhaps, never been approached since.

At the beginning of the 3rd century the independence of Greece had been lost, together with many of her foreign conquests and colonies. Rome began to intervene in her affairs, and for long centuries after, as well as before, the great Roman Empire completely fills the stage of European history.

The city on the Tiber which became the capital of that Empire is said to have been founded by Romulus, a descendant or son of the Trojan hero Æneas, who escaped into Italy after the fall of Troy; but the story of early Rome, like that of early Greece, is lost in myth. The territory over which it originally held sway was far from continuous with modern Italy. Rome was originally a small city on the Tiber, built by the Latin tribes to overawe, or defend themselves against, the Etruscans, who had been earlier settlers in the north-western part of the *peninsula proper*, known as Etruria. The generally accepted date of the foundation of Rome is B.C. 753. Its earliest government was one by kings; but of cities, rather than of territories, when the form of government became by degrees republican. The commonwealth which succeeded, after enduring many changes, came to an end in reality (though several times revived later) with the accession of Augustus Cæsar in 27 B.C. The early centuries of Rome's existence are very much a record of the numerous wars waged with hostile tribes occupying the peninsula. There she received her training as a martial nation, and displayed the martial prowess which eventually subdued the world. It was not till about 343 B.C. that she accomplished the conquest of all *peninsular* Italy, which occupied sixty years. The Commonwealth was, in many respects, the most glorious epoch of her history, and in that period were laid the foundations of her enduring fame. Its later years were made memorable by the Punic wars, the third of which ended with the destruction of Carthage and the creation of the Roman province of *Africa*. She next swept Greece and Macedonia, and founded the Roman province of *Asia*. Leaving now nations to some extent civilised like herself, she turned to her native Italy and subdued Cisalpine *Gaul*. This completed her *Italian* conquests, and she was now mistress of the entire Italian *peninsula*. She next attacked the third southern peninsula, and early in the 2nd century conquered *Hispania* and made it a Roman province. Crossing the Alps, she next attacked Transalpine *Gaul*, to be met by a simultaneous invasion of the Cimbri or *Teutones*, in the encounter with whom she came off final victor. Rome was now mistress of the entire Mediterranean littoral, with the exception of Egypt. This vast domain was governed directly from Rome by means of proconsuls, and over its wide extent Roman laws prevailed, and the civilisation of Rome gradually spread. We pass over the great Mithridatic wars, the Servile wars in Italy, and the many internal distractions of Rome; the conquest of *Syria*, and its erection into a Roman province, and come to one of the era-making events in Roman history. We refer to the extension of Roman *Gaul*

to the banks of the Rhine by Julius Cæsar—a conquest which first brought the two great divisions of Northern and Southern Europe face to face. It was this same Cæsar who effected the landing in Britain, though *Britain* was made a Roman province later; and it was in the reign of his grand-nephew that Rome completed the circuit of the Mediterranean littoral by the annexation of *Egypt*. Julius Cæsar may be regarded as the *actual* founder of the Roman *Empire*, which reached its zenith in the reign of his grand-nephew, who first bore the title of *Augustus*, and is known in history as Augustus Cæsar. The Roman Empire now included the whole civilised world. Its frontiers were the *Rhine*, the *Danube*, the *Euphrates*, and the great *deserts of Africa*, and it stretched 1,000 miles from east to west, and 1,000 miles from north to south—a marvellous achievement for a people who possessed neither of those powerful aids to modern conquests—gunpowder and steam navigation.

The great secrets of the rapid rise of this vast empire were that military discipline and civilisation which were then for the first time in history opposed, on any great scale, to barbarism. Rome had next the wisdom to confer her citizenship, not only on her allies, but on the nations she subdued. *Civis Romanus* became one of the proudest of the world's titles. Roman *laws* again, Roman *civilisation*, and Roman *roads* followed in the train of the Empire everywhere.

The reign of Augustus Cæsar was the golden age of the Roman Empire. The *Augustan age*, as it has been named, produced orators, historians, and especially poets, whose productions have ranked as the classics of every succeeding age, and, with those of illustrious Greek writers, have been the foundations of all liberal education ever since. The accession of Augustus Cæsar may, perhaps, be regarded, strictly speaking, as the beginning of the Roman Empire, which succeeded the long 700 years of early kings and later commonwealths; and it only ended, shorn of the last fragments of its once vast territories, on the fall of Constantinople in A.D. 1453.

The rise of Christianity in the early years of the Roman Empire in one of its obscure provinces in South-Western Asia; the gradual spread of the new faith over the whole Empire; the conversion of the Emperor Constantine in the 3rd century; and the final overthrow of paganism in the Roman dominions within 400 years, are, perhaps, the most memorable events in the history of Europe and of the world. Not only has the faith of Europe been changed, but Christianity has since become the religion of a large part of Africa and of parts of Asia, as well as of the two youngest continents; and it is being steadily propagated among heathen peoples in every quarter of the globe.

We now proceed to a very superficial survey of the leading events which tended to the *transfer of the balance of power in Europe* from the Latin to the Teutonic and allied races. Rome received her first serious check in an unsuccessful attempt to subdue the Germans *beyond the Rhine*. If that region had become a Roman province, the whole course of European history might have been changed.

The defeat of Rome weakened the *prestige* of the Roman Empire in the West, and stemmed the march northwards of its till then invincible arms. The Teuton had now learnt his strength, and his subsequent successes on the borders of the Roman Empire in Western Europe were much accelerated by the pressure from behind of a great Turanian invasion—that of the *Huns*—who occupied part of the northern shore of the Black Sea, and who had lately been driven out of China. The Goths, a Teutonic people, who had recently formed a powerful kingdom on the *north* of the Danube, the site of the abandoned Roman province of Dacia, were driven by this *force majeure* into Roman territories *south* of the Danube. There they made a permanent stand. Other Teutons pressed into *Gaul*, and from Gaul into *Spain*. At length a common danger united all the Western peoples of Europe to withstand an invasion led in person by Attila, the renowned King of the Huns. His signal defeat at *Châlons* was one of the decisive battles of the world. An adverse result might have driven Europe back into the barbarism of Asia. The gradual spread of the *Teuton* over the whole of Europe south of the Rhine, and as far to the south-east as modern Turkey, led to the formation of those various hybrid peoples known in history as the *Romance* nations of Europe. These people are a cross more or less pronounced between branches of the barbarians of Central and Western Europe and the Latin and other races of the Italian peninsula, with some admixture of Greek blood. In the reign of the German Emperor of the West, Theodoric (about 500 A.D.), the transformation of Europe may be said to be complete. The countries now known as Spain and Portugal, with France to the west of the Rhone, formed the *West Gothic* Kingdom, with the exception of the small Suevie or *Swabian* Kingdom, at the north-west corner of modern Portugal and Spain. The part of modern France which lies east of the Rhone was a *Burgundian* kingdom: north of both was the *Frankish Kingdom*, the present German Empire; and north of it again, *Saxons and Danes* (the former of whom had also effected settlements in south-eastern *Britain*) occupied the site of the modern duchies of Schleswig and Holstein, Denmark, and the southern parts of Sweden and Norway, while Celts occupied the rest of Great Britain and Ireland. Italy and part of Austria were the East Gothic Kingdom. Only the present Turkey and Greece remained to Rome in Europe. All these vast changes were the slow growth of long time, and were not effected without many protracted struggles; but the stronger race eventually supplanted the weaker. The Roman Emperors of the West ceased to be *Latin* and became *Teutonic* of various branches. With the transference of the seat of empire from the West by Constantine to the old Greek city *Byzantium* on the Bosphorus, and hereafter known as Constantinople; the conversion of the Emperor to Christianity; the formal recognition of Christianity as the religion of the Empire, the *Germanising* of the Roman Empire in the West may be said to be nearly complete—though the dynastic changes we have glanced at were not fully concluded for

more than a century afterwards. It was henceforth the *Roman* Empire only in name. The erection of *New Rome* on the banks of the Bosphorus was the great political division of the Empire. It was now split in twain into two sections, an Eastern and a Western—the one *Greek, Asiatic*, and *African*, the other *Teuton*—just as the Church of Rome was divided into two great communions of Eastern and Western by the dispute about images. The result was a *Teuton* and a *Greek* empire, and a *Roman* and *Greek* communion. The transfer of the seat of government from Rome to Milan accelerated perhaps the fall of the Western Empire. Rome was taken A.D. 476 by Odoacer, who assumed the title of King of Italy, and an Empire which had weathered ten centuries ceased to be. It still lingered on, in name at least, in the far East, when it finally expired, gradually shorn of its power and of the last vestige of its once world-wide possessions, when Constantinople was sacked by the Ottomans. This is a mere rough outline of leading events in European history, the details of which (including the rise of the Ottoman power) must be sought from other sources. The rise to the first rank of the great kingdoms of France and Spain, the first coming to the front of the *Low Dutch* races of Holland and England, the rise of the great semi-Asiatic empire of *Russia*, the establishment of the United States of America, can only be just mentioned as landmarks on the chart of European history.

With the fall of Constantinople (A.D. 1453) the Eastern half of the Roman Empire, or what fragment remained of it, was usurped by a great Ottoman power, and a Mohammedan and Semitic people gained a settlement in Southern Europe.

The fall of the Western Empire was the real origin of the temporal power of the Popes. They had always acted as the vicegerents of the often non-resident German and other emperors, and when the capital was finally abandoned they grasped the fallen sceptre. Revolution and anarchy beset the once capital of the world. The Popes suffered many years of exile; but when they returned to the Christian Zion they resumed their old authority. Their rule was, on the whole, beneficent in a dark and lawless age, if it was sometimes abused. Their territorial dominions in Italy belong to a later period.

We can only just mention such facts as being the germs from which mediæval and modern Europe were gradually evolved. Nor can we do more than make a passing allusion to that great wave of religious enthusiasm which in the 11th, 12th, and 13th centuries sought to wrest the Holy Land from the grasp of the infidel Saracens. The growth of *monastic institutions* led to a great revival of learning in the Middle Ages; and the increasing hold of the Christian faith on the minds of men is strikingly illustrated by the splendid ecclesiastical structures which stud the land, and remain now the undying monuments of the piety of those distant times which a more sceptical generation has designated the Dark Ages. The great religious revolt against Rome, which lasted in various countries of Europe from the 10th to the 15th century, marks that new era of religious

liberty which over a considerable part of the Christian world has succeeded the spiritual slavery and superstition which prevailed to some great extent in the Middle Ages. The French Revolution in the 18th century marks equally the fall of that monarchical and military despotism which had spread so widely over Europe, and the rise of civil liberty everywhere on its ruins. But we must draw this mere "bird's-eye view" of the subject to a close. The Teuton, mixed with the Celtic and old Latin races of Italy, lords it already over three continents and half of a fourth, and he sways the great Asiatic peninsula of India. Only Russia remains the enigma in the future course of European history. The long-vexed "Eastern Question" may yet again change the face of Europe. The unification of the great races of Northern Germany, the rise of the little kingdoms of Italy and Greece, the struggle for political independence among the Slavonic races of the Balkan peninsula—all these are symptoms of a vigorous national life in Europe; but the English race still leads the van of Teutonic progress. The old empire of Rome was insignificant compared with that of Great Britain.

Such is the splendid fabric which has risen in twenty-six centuries from the little seven-hilled city on the Tiber—well named the Eternal City.

Euryalida, the group of Ophiuroidea (q.v.) which includes those with many and twining arms, such as the Medusa Head (*Astrophyton*). The earliest known members of the class are the *Euraladia*, from the Silurian rocks of Dudley, and the *Oncycheaster*, from the Carboniferous of Illinois.

Eurydice, a well-known character of classic fable. A snake-bite led to her passage from earth to Hades, and her husband, Orpheus, whose lute charmed stocks and stones and subdued savage beasts, set out to try the effects of music on the powers below. He silenced Cerberus, and drew iron tears down Pluto's cheek, and his wife was restored on condition that he should not look at her as she followed him till they reached the upper air. His great love was not proof against temptation. He turned, looked, and lost her. The story is prettily told by Virgil in the *Georgics*.

Eurypterida, an extinct order of *Arachnida*, which occur principally in the Upper Silurian and Devonian rocks. The three best-known genera are *Eurypterus*, *Ptergotus*, and *Stimonia*. They were all marine, and swam about by means of four pairs of large appendages around the mouth. There were no limbs on the abdomen, but this ended in a large, expanded telson. The order has certain affinities with the Trilobites, and both were once included among the Crustacea.

Eusebius (265-340), the earliest of Church historians, was born in Palestine. In 315 he was Bishop of Cæsarea, and from being an opponent of the Arians he ended by siding with them against St. Athanasius. He wrote a history of the Church from the birth of Christ to 324, in Greek. There are several editions and translations of it. Of his *Chronicon* there are fragments, and a translation by St. Jerome. He wrote a *Preparatio Evangelica*

in 15 books, and a *Demonstratio Evangelica* in 20 books, of which 10 exist in an imperfect form. He also wrote a notice of the Emperor Constantine. It is a question how far his history is to be trusted.

Eustathius, a Greek commentator of the 12th century, was a native of Constantinople and Archbishop of Thessalonica and of Myra. He was a great classical scholar, and commented upon Homer and Dionysius. Much of the value of his writings consists in his quotations from works now lost.

Euthanasia (Gk. *eu*, well, *thanatos*, death). About 1873 it was proposed that in all cases of incurable disease it should be the recognised duty of the medical attendant painlessly to put the sufferer to death. But there are obvious objections to it, grounded especially on its ethical dangers. The word is older in the sense of a painless death.

Eutheria, a sub-class of Mammalia (q.v.) comprising the placental mammals.

Eutropius Flavius was a Roman historian who lived in the 4th century, but of whose history and birthplace little, if anything, is known. He served under the Emperor Julian, and is known by his *Breviarium Historiæ Romanæ*, an epitomised history of Rome from its foundation down to the time of the Emperor Valens.

Eutyches, an ecclesiastic of the 5th century, was the superior of a monastery near Constantinople. He was at first inclined to the Nestorian heresy that Christ possessed two distinct natures, but afterwards adopted a modification of the Monophysite heresy, and for this he was excommunicated by the Council of Constantinople in 448. He was afterwards restored, to be again condemned, together with the Nestorians, by the Council of Chalcedon in 451. From that time he disappears from history, but his views were continued by a sect which bore his name.

Evander, a son of Hermes and an Arcadian nymph, who being for some cause compelled to quit the country and his native town Pallantium, about sixty years before the date of the Trojan War, went to Italy with a colony of Pelasgians, slew the king of Præneste, and built another Pallantium at the foot of what was afterwards the Palatine hill, and proceeded to civilise Latium, introducing literature, agriculture, music, and the worship of his native Greek gods. Æneas is said to have been well received by him.

Evangelical, Evangel (*Gospel*), in a strict sense, that which has to do with or partakes of the nature of the Gospel. In a wider sense it is applied to such sects or religions as aim at regulating their lives by the Gospel. It is also applied in a special sense, as for instance to the National Church of Prussia, or to that party in the English Church otherwise known as Low Churchmen.

Evangelical Alliance, a confederation of evangelical denominations, first instituted at a World's Convention at London in 1846, and having for its object the promotion of Christian intercourse among orthodox Protestant denominations and co-operation in good works.

Evangelical Union, THE, was founded in 1843 by several Scottish ministers, the chief of whom was James Morison, of Kilmarnock, who had been expelled from the United Secession Church for holding anti-Calvinistic views. From him they are sometimes called Morisonians. In Church government they are Independent, in doctrine Arminian.

Evans, SIR DE LACY (1787-1870), an English general. He went young to India as an ensign, and saw some service there. In 1812 he went to the Peninsula, and took part in many of the chief engagements. In 1814 he went to America, where he was wounded, and arrived in Europe in time to take part in the battle of Quatre Bras. After the peace he gave his attention to politics, being ardent in the cause of Reform. In 1830 he sat in Parliament for Rye, and in 1833 for Westminster. In 1835 he took command of 10,000 troops, who were raised by permission of the Government to take part in the Spanish war against the Carlists, and he made good soldiers of them. In 1837 he was made K.C.B., and in 1846 Major-General. He took part in the Crimean War, and was present at Alma, Inkermann, and Sebastopol. He received the thanks of Parliament, the Grand Cross of the Legion of Honour, and the G.C.B. He then returned to politics and Parliament.

Evaporation is a process of diffusion of the particles of a substance, either liquid or solid, into the surrounding medium. If from the solid state the process is called *sublimation*. If the transition from liquid to vapour, or from vapour to liquid, be perfectly free, which can only occur when the pressure of the vapour is sufficient to overcome the external pressure, the process is called *ebullition*, or boiling. [EBULLITION.] At any pressure a certain amount of evaporation may occur. Thus, even ice may evaporate, though it is obviously far below its boiling-point; and in course of time may entirely disappear. The amount of evaporation at a temperature below boiling-point depends chiefly on that temperature, but other local conditions, such as pressure, may also hold. Heat is required to effect the change from the liquid to the gaseous state, and inasmuch as this heat disappears as such, it is termed the *latent heat* of evaporation. If t is the temperature of free evolution of water-vapour Regnault gives the amount of latent heat as $606.5 + .305t$, the temperature and the heat unit being in degrees Centigrade. This production of cold, for as such the subtraction of heat may be regarded, is found practically useful. Liquid carbon dioxide may be in part frozen by the evaporation of part, a process that is applied in various other cases. [HEAT.]

Evelyn, JOHN (1620-1706), was born at Wotton, Surrey, where his family owned an estate. He studied at Oxford and at the Middle Temple, and then travelled for some time. His exertions for the Royalist cause won him consideration at Court after the Restoration. He was one of the early members of the Royal Society. In 1662 he published a *History of Engraving upon Copper*, but the work by which he is chiefly known is the *Sylva* (a treatise

on forest-trees), with its appendix *Pomona* upon fruit-trees. In James II.'s reign he was one of the Commissioners of the Privy Seal, and after the Revolution he was made treasurer of Greenwich Hospital. His diary and correspondence have been published, and many miscellaneous works on gardening, architecture, medals, a burlesque account of women's toilet called *Mundus Muliebris*, and the *Fop's Dictionary*.

Everest, MOUNT, a name given to Gaurisankar, a peak of the Himalayas in Nepal, in honour of Sir George Everest, Surveyor-General of India. It is the highest measured point of India and of the globe, being over 29,000 feet high.

Everett, ALEXANDER HILL (1792-1847), an American diplomatist, born at Boston. He studied law under John Quincy Adams, with whom he went to St. Petersburg (1809-1812). He next practised law for a time, and was then appointed secretary of legation in Holland, and (1818-1824) *chargé d'affaires*. From 1825 to 1829 he was in Spain, and was elected a senator of Massachusetts on his return. In 1840 he was sent on a mission to Cuba, and in 1846 to China, where he died. He produced a work upon Europe (1822), and one on America (1827).

Everlasting Flowers, various species of the genera *Helichrysum*, *Helipterum*, *Xeranthemum*, etc., belonging to the order *Compositæ*, which agree in having an imbricate involucre of dry or "scarios" bracts, often brightly coloured and retaining much of their beauty when dried. *Helichrysum orientale*, the "Immortelle" of the French, with small yellow heads of flowers, often bleached or dyed black, green, or orange, is a native of Crete and North Africa; but most of the species are natives of South Africa, Australia, and Tasmania. Yellow, pink, crimson, and white are the chief natural colours of the bracts of the various kinds. They are largely used for funeral wreaths.

Eviction, dispossession or ouster of possession. The term is generally applied to ouster from real property only, but it is also applicable to dispossession from personal estate. The usual covenant for quiet enjoyment contained in leases and other deeds is practically a covenant against eviction. A landlord may legally evict his tenant for good cause, but he will be guilty of a wrongful eviction of his tenant if he, without proper cause, actually or physically, evicts him, or does any act of a permanent character with the intention of evicting, and which is inconsistent with the tenant's returning or continuing in possession.

Evidence consists of facts brought forward for judicial or other purposes as the maintenance or refutation of a proposition of any kind. By the law of England the body of rules known as the law of evidence has been gradually established during the 18th and 19th centuries. It is a system of restrictions upon the admission of testimony, showing that in this country, at least, the inclination has, up to a comparatively recent period, been to circumscribe and not to extend the admission of evidence. In our earlier judicial proceedings the practice was

to admit without hesitation or question every species of testimony, whereas the existing law of evidence is largely composed of restrictive rules, though these have in recent years been considerably relaxed.

Evidence in a legal sense must be either oral or written, and is always given on oath of the party, except in the case of Quakers and Moravians, but the form of the oath is immaterial. A Christian is sworn upon the Gospels; a Jew upon the Old Testament, with his head covered; and a Mohammedan or other non-Christian in such form as he considers binding on his conscience. All persons who have understanding enough to know the nature and obligation of an oath are admissible as witnesses.

As a general rule, the party who affirms a thing must prove it, and he must give the best evidence which the nature of the case requires, and, as a general rule, hearsay testimony is not admitted; but there are exceptions to this rule, as, for instance, the testimony of dying persons [DECLARATION], the declarations of deceased persons made against their interest and respecting rights of a public nature, such as the boundaries or general customs of a manor or district.

Written evidence consists of records, documents under seal as charters, and deeds and writings not under seal. Acts of Parliament are records of the highest nature, being the memorials of the legislature. There is, however, a distinction between public and private statutes. A public statute requires no proof in courts of justice, but private statutes must be evidenced by comparison with the originals. A second and inferior kind of records is the proceedings of courts of justice, which are evidenced by exemplifications sworn and office copies. Exemplifications are transcripts of the records of different courts accredited by having the seals of such courts attached. Sworn copies are transcripts made by individuals, who authenticate them upon oath when they are produced in evidence. Office copies are copies certified to be true and accurate by an officer expressly intrusted with that business of the court to which the records belong.

The present leading rules of evidence are as follows:—

1. The sole object and end of evidence is to ascertain the truth of the several disputed facts or points in issue, and no evidence should be admitted which is not relevant to the issues.

2. The point in issue must be proved by the party asserting the affirmative, according to the maxim *affirmanti non neganti incumbit probatio*; but where one person charges another with a culpable omission or breach of duty this rule will not apply, for the person who makes the charge is bound to prove it, though this may involve a negative, since it is an established principle of justice not to presume that a person has acted illegally till the contrary is proved.

3. It is sufficient to prove the substance of the issue.

4. The best evidence must be forthcoming of which the nature of the case is capable.

5. Hearsay evidence of a fact is not admissible. (See above.)

6. No person is bound to criminate himself for *nemo tenetur prodere se ipsum*. The mode of taking evidence in the Common Law courts differed from that which was usual in the Court of Chancery. It was oral in the former and by affidavit in the latter. Now, however, that there is one Supreme Court, the ordinary mode of taking evidence is by oral examination of witnesses; but by agreement or by leave of the court or a judge affidavits or depositions may be used in the Chancery division.

Witnesses in courts of law are produced before the court and examined by counsel, after which they may be cross-examined by the counsel for the other side.

When the evidence is completed on both sides, the judge, in the presence of the parties, the counsel, and all others, sums up the whole to the jury, recapitulating in greater or less detail, as he may deem necessary, the statements of the witnesses, and the contents of the documents adduced on either side, commenting upon the manner in which they severally bear upon the issue, and giving his direction upon any matter of law that may arise upon them, but leaving the jury to determine for themselves the credit and weight to which they are respectively entitled, and to decide whether, upon the whole, the preponderance of proof is in favour of the plaintiff or defendant.

The jury, after the proofs are summed up, if they express a wish so to do, withdraw from the court to consider their verdict, and are kept till they are all agreed.

Trials may, however, now be before a judge or a judge with assessors alone without a jury, and a notice of trial given generally means a trial before a judge without a jury.

In the United States there is now, in consequence of recent legislation, scarcely any restriction as to admission of evidence.

Circumstantial Evidence is the term applied to *indirect* as opposed to *direct* evidence; such evidence is also sometimes known as "presumptive," because when the fact cannot be established it may be presumed by the proof of such circumstances as usually attend such fact. [PRESUMPTION.]

Evil Eye, a term used to denote the widespread superstition that certain persons can exercise a pernicious or blighting influence on other persons or on the lower animals by looking upon them. This superstition existed in classic times. There are two distinct forms of this fascination or bewitching: in the first, and more usual kind, the ill effects are willed by the possessor of the evil eye; in the second, these effects are produced involuntarily, or even directly against the will of the person endowed with this terrible power. The exercise of the first form is popularly known as "overlooking," and a person suffering from its blighting influence is said to be "overlooked." These words have lost this meaning in modern English, but examples will be found in Pistol's reproach to Falstaff (*Midsummer Night's Dream*, v. 5) and in Portia's exclamation to Bassanio (*Merchant of Venice*, iii. 2); whilst many other instances of about the same date might be cited.

The English notion of the evil eye is capitably expressed in Kingsley's translation of Lucy Passmore's hints :—"If you trouble me, I will overlook (i.e. fascinate) you, and then your pigs will die, your horses stray, your cream turn sour, your barns be fired, your son have St. Vitus's dance, your daughter fits, and so on, woe on woe, till you are very probably starved to death in a ditch, by virtue of this terrible little eye of mine" (*Westward Ho!* ch. iv.). And the race of "Lucy Passmores" has not yet died out. The second form is chiefly found in Southern Italy, where it is known as *la gettatura*. The possessor of this fatal power is usually a man, frequently a cleric, and it was attributed to Pope Pius IX., though in former times the power of the evil eye was supposed to belong almost exclusively to women. Against both forms amulets and charms were and still are employed. Spitting on the ground was supposed to be an infallible safeguard. With regard to the origin of this superstition, Dr. Tylor says "that it seems not unreasonable to suppose that the belief in the mysterious influences of the evil eye flows from what the eye can do as an instrument of the will. The horror which savages so often have of being looked full in the face is quite consistent with this feeling. You may look at him or his, but you must not stare, and above all you must not look him full in the face—that is to say, you must not do just what the stronger mind does when it uses the eye as an instrument to force its will upon the weaker."

Evolute, in *Geometry*, is the term applied to the envelope of the normals to a curve at every point, the normal being the line at right angles to the tangent at its point of contact. The given curve is called the *involute* (q.v.), and from the definition it follows that if a thread be regarded as lying along the one evolute, its end point when unwound on the convex side of the curve traces the other involute. Thus, the involute of a circle is a spiral of special type, as may be shown practically by unwinding a thread from an ordinary reel. The evolute of this special curve is the circle itself. [INVOLUTE.]

Evolution. 1. In *Algebra* or *Arithmetic*, is the inverse process of *involution* (q.v.), and as such requires a primary knowledge of the latter. Its manipulation is either effected directly by systematic guess-work, known as the process of square-root, cube-root, and the like, or indirectly by the same through the medium of logarithms. But the latter being applicable only to known numbers, can be used in arithmetical evolution only; nevertheless, its general applicability in solving any root whether integral or fractional renders it highly useful.

2. A theory which regards all higher or more complex forms of existence as following and depending on lower and simpler forms—the cause of this gradual transition being immanent in the lower form of existence which is thus transformed. It is thus an attempt to solve one of the two main problems of philosophy. The first of these problems is the ultimate nature of reality, or mind and matter in relation to one another, the static aspect of the world: the second, which

evolution attacks, is the dynamical question of becoming, how have things become what they are, and how are they now being changed. As a cosmogony (q.v.) evolution conflicts, at least partially, with the theory of emanation, which had an Oriental origin and was developed by the Neoplatonists, Gnostics, Arab philosophers and Cabalists, and with that of direct creation by a personal deity.

The foundation of the modern mechanical conception of nature and of physical evolution was laid by Descartes; added to by Leibnitz's theory of sentient monads; illustrated from the history of human progress by Pascal, Priestley, and Lessing; applied to the heavens by Kant and Laplace; and to the whole of nature and mind by Schelling and Hegel. The theory of descent or the derivative origin of existing species of plants and animals practically dates from the works of Lamarck and Treviranus in the first decade of the nineteenth century—neither Erasmus Darwin nor Goethe having essentially strengthened the position of the theory as more than a poetic fancy. The authority of Cuvier retarded the acceptance of the theory by biologists; but after the middle of the century many independent lines of research outside the field of biology prepared the way for its firm establishment.

Experiments on the mechanical production of heat and the chemical production of electricity led to the generalisation of the conservation of energy. The work of Black and Lavoisier in demonstrating the indestructibility of matter was extended by means of the spectroscopy in the hands of Kirchhoff, Bunsen, Huggins, and others to the showing that the chemical elements of the heavenly bodies are the same as those of our earth. The same process of observation gave a firmer footing of fact to the nebular hypothesis of Kant and Laplace. The use of fossils by William Smith as indicating succession among sedimentary rocks, the restoration of these extinct forms of life by Cuvier and other palæontologists, and the insistence by Hutton, Playfair, and Lyell on the sufficiency of existing physical agencies to explain the facts of geology, called attention to the immensity of the age of the earth and to its having been successively inhabited by races of plants and animals different from, and in many respects lower than, those now living. The discoveries of McEnery and Boucher de Perthes in bone-caves and river-gravels conclusively established the great antiquity of man (q.v.) on the earth, and suggested his advance in culture from the most helpless barbarism; and the application of the comparative method to the study of languages prepared the minds of scholars for similar conclusions.

Cuvier had shown biologists the existence of fundamental types of structure in groups adapted to varied modes of life and the "serial homology" of parts, such as the limbs of animals and the leaves of plants, modified for distinct functions; and Von Baer's (q.v.) parallel between the development of the individual and that of the race had shown the bearing of embryology (q.v.). When, in 1858, Darwin (q.v.) and Wallace brought forward the principle of natural selection as the mode of

organic evolution, Mr. Herbert Spencer had already elaborated a consistent philosophy of evolution in which this principle readily found its place. In the *Origin of Species* the facts of the geographical distribution of organisms and of the existence of rudimentary or vestigiate structures were set forth in their true bearing on the general theory; and, so far as biology is concerned, the result of the last 30 years' investigations has been to make every biologist an evolutionist, though the relative importance of the principle of natural selection, of the influence of the environment (q.v.), and of other processes, in the production and preservation of varieties is still a matter of dispute.

Darwin suggests an ethical extension of his views in defining the general good as "the rearing of the greatest number of individuals in full health and vigour and with all their faculties perfect under the conditions to which they are subject," and Mr. Spencer similarly looks on human progress as a gradual process of self-adaptation of man to his environment—i.e. of increasing happiness. [DARWINISM, DEVELOPMENT, ENVIRONMENT, MIMICRY, NATURAL SELECTION, etc.]

Evora (ancient *Ebora*), a town in Portugal, capital of the province of Alentejo, 80 miles E. of Lisbon. It was an ancient fortress, though its walls and defences are now in ruins, and the Moors received a memorable defeat there in 1166. It is the see of an archbishop, and the cathedral dates from 1186. There is a college and a seminary. The chief manufactures are ironware and leather, and there is an annual fair.

Evreux (ancient *Civitas Eboracorum*), the capital of the French department of Eure, 57 miles N.W. of Paris, in the valley of the Iton, which divides the town into three parts. It has a good cathedral, with a spire 256 feet high, an interesting abbey, and an hôtel de ville, which was once a palace of the Dukes of Bouillon. Among its industries are the manufacture of hosiery and leather, and there is a considerable trade in cattle, corn, seeds, and timber.

Ewald, GEORG HEINRICH AUGUST VON (1803–1875), a German Orientalist, was born at Göttingen, at the university of which he studied theology and philosophy, and became professor of philosophy and of Oriental languages. His protest against the revocation of the Hanoverian Constitution led to his deprivation, and he eventually obtained a professorship at Tübingen. He was one of the leaders of the so-called "Tübingen school" of rationalistic and critical theology. His career was much checked and marred by his refusal to acknowledge Prussian supremacy. He wrote many philological works, and had a special gift of insight for interpreting the genius of the Hebrew nation and its sacred writings. His *History of the People of Israel* is his chief work.

Ewald, JOHN (1743–1781), a Danish poet, was born at Copenhagen and educated in Schleswig. As a boy the reading of *Robinson Crusoe* made him run away in search of a desert island, and a few

years later he ran away again and enlisted in the Prussian army, but being disappointed at being made an artilleryman instead of an hussar, he deserted to Austria, where he might have gained promotion if he would have changed his religion. He was bought off by his friends and returned to Copenhagen, where the success of an elegy upon Frederick V. of Denmark led him to turn his attention to poetry, and he became renowned for his lyric and tragic poetry. *The Death of Balder* is the best known of his works, which have been published in 4 vols. The poet died in what was almost poverty. He is the author of *King Christian stood by the Lofly Mast*, the national hymn of Denmark.

Ewe, properly EHWE (*pron. Eh-weh*), a numerous negro people whose various branches occupy a great part of the Slave Coast, Upper Guinea, between the river Volta on the west and Yerubaland on the east, and extending for an unknown distance inland. Ewe-land thus comprises Dahomey and the whole region stretching thence westwards to the Ashanti and Ga peoples of the Gold Coast. The chief tribal divisions are:—Ehweawo, Anfueh, Krepe, Avenor, in the extreme west; Awuna, Afiao, Geng, on the coast; Ffon (Dahoman) and Elhwemi, in the extreme east; Krikor and Ataku inland from the Kota lagoon; Makki (Mahi), Attakpami and Aja of the mountains in the far interior. According to the national traditions, the Ewe people migrated from these mountains seawards some centuries ago, and some of the national usages seem to imply close contact with the Saharan Tuaregs (Hamites) in their original homes. But if they were originally Hamites the Ewe have long been assimilated in appearance, customs, and language to the surrounding negro populations. Their speech is fundamentally connected with the Ga and Tshi of their western neighbours, and with the Yoruba on the east, all these being so many distinct branches of a widespread negro linguistic family which occupies the whole region from the Lower Niger westwards to the Ivory Coast. In this region the progress of culture has been from east to west, so that in this respect the Ewe take an intermediate position between the barbarous Tshi and Ga peoples of the Gold Coast and the semi-civilised Yorubas east of Dahomey. Formerly the Spanish and French planters of Central America, the West Indies, and Louisiana, drew their chief supply of slaves from the Ewe-speaking tribes exported from Whydah and Bagary; hence the term *rodu*, which in the Ewe language means a supernatural agency, is still current in various forms (*vandoo*, *vandoua*) amongst the negro peoples of Hayti, the Lower Mississippi, and other countries first settled by Spanish and French colonists. The voodoo practices surviving in these regions are found nowhere in the parts colonised by the English, who imported their "Coromantees" mainly from the Tshi-speaking populations of the Gold Coast. The standard work on the Ewe nation is Major A. B. Ellis's *Ewe-speaking Peoples of the Slave Coast of West Africa*, London, 1890.

Ewing, JULIANA HORATIA (1842-1885), writer for children, daughter of Mrs. Gatty, was born in Yorkshire. The nursery plays which she composed as a child are said to have given her mother the idea of *Aunt Judy's Magazine*. Mrs. Ewing contributed to this, and succeeded her mother in editing it. Her tales are well known to both old and young.

Exanthemata, the class of fevers attended by skin eruptions—*e.g.* scarlet fever, measles, German measles, small-pox, chicken-pox, typhus, etc.

Excalibur, the magic sword which King Arthur received from the Lady of the Lake. Tennyson tells us how the "arm, clothed in white samite, mystic, wonderful," gave Arthur the sword, and received it again when Sir Bedivere flung it at the King's command into the mere.

Excavators are labour-saving machines much employed at present for the removal of earth in the making of docks, railways, and the like. They are of two kinds, the first being a single scoop raised or lowered by crane mechanism, and arranged with jaws that cut out a certain quantity of earth on being drawn together by steam or other such motive power. The second is precisely similar to the steam-dredger with its endless chain of buckets. [DREDGING.] The first possesses the advantage of variety in movement and general applicability, the second of economy in time required for the excavation of a given amount of material.

Exchange, in political economy, denotes first the practice—in its simplest form, barter—of a man's changing goods of which he has produced or obtained an excess, for goods of which another has an excess but of which he himself has need. Commercially the word often signifies the practice prevailing among merchants of different towns or countries of regulating their mutual accounts without the transfer of money from the one country or the other. To take the simplest form, the *bill of exchange*: suppose A in London buys goods of B in Antwerp. B has bought goods to a like amount in value in London. A, instead of remitting money to B in Antwerp, pays it over to B's London creditor on B's order, *i.e.* B "draws a bill" on A in favour of the creditor, and sends it to A for "acceptance." [DISCOUNT, BILLS.] The question as between countries is complicated by the different and varying proportion of the value of the currency of one country in the other, the prevailing rate of exchange, as it is called, requiring special adjustments. Exchange is "at par" when imports exactly balance exports, and the premium is a measure of the demand for bills, to save the risk of remitting specie. Exchange also is the name given to the building where merchants meet to adjust accounts and transact business. Such is the Royal Exchange of London, built by Sir Thomas Gresham in imitation of the Bourse at Antwerp. Exchange in law is where an estate is exchanged for one of similar value and limitation—*e.g.* fee-simple for fee-simple, life-estate for life-estate.

Exchanges, THEORY OF, in heat, is associated with the name of Prévost, who first definitely formulated it. A body possessing heat is continually

giving out heat, either by conduction, convection, or radiation. This is the case whether the surrounding media are at higher or lower temperatures than the body itself. To take the one case of radiation, the amount of heat emitted is a function of the temperature of the body, and is constant if the temperature is constant. This is true for all bodies, and it must not be imagined that heat proceeds therefrom only in the event of these bodies being at higher temperatures than their surroundings. When their surroundings are at the same temperature they receive just as much as they emit, and their heat-intensity or temperature remains constant. When their surroundings are at lower temperatures they receive less than they emit and cool down in consequence; and conversely when they are at higher temperatures than their surroundings. If, therefore, a body having a good reflecting surface is placed in a medium bounded by another surface at the same temperature, it follows from the theory that inasmuch as its temperature remains constant it reflects much, radiates little, and absorbs little. If its surface is a good absorbent it reflects little but radiates much and absorbs much. Hence the general deductions that good radiators are bad reflectors but good absorbers, and that bad radiators are good reflectors but bad absorbers. [HEAT.]

Exchequer, in England, the financial department which receives or pays moneys due to or owed by the Government. The Chancellor of the Exchequer, now an officer of the Government, formerly had jurisdiction in the Court of Exchequer, which at first adjudicated upon cases in which the revenues of the Crown were concerned, but later, by a legal fiction, became an ordinary court of law. Its judges were known as Barons. The word is also used in the generic sense of a state treasury, and colloquially of any treasury public or private.

Excise, the name given to taxes or duties levied upon articles of consumption which are produced within the kingdom. There are, however, some duties to which the term is applied which can scarcely be called duties upon consumption, such as the sums charged for licences to permit persons to carry on certain trades or professions, as auctioneers, solicitors, etc., and the licences to kill or deal in game, keep dogs, etc.

Excise duties had their origin in England in the reign of Charles I., when a tax was laid upon beer, cider, and perry of home production by the Long Parliament in 1643. This Act prescribes also a list of foreign articles upon which excise duties were imposed in addition to duties of customs already chargeable. This Act was adopted and enforced under Cromwell, and by a statute passed in the reign of Charles II. the duties of excise were granted as part of its revenue to the Crown.

Excise duties are subject to the serious objection that the regulations under which they are collected interfere with processes of manufacture so as to prevent the adoption of improvements; hence their unpopularity in past times. But, however odious formerly to the people of England, these taxes are now viewed with more toleration, and are allowed

not only to be a convenient and effective species of impost, but to be attended with this collateral advantage—that the supervision of the revenue authorities tends to protect commodities subject to excise from fraudulent adulteration. In 1849 the Excise Department was amalgamated with that of Stamps and Taxes to form the Board of Inland Revenue. The only items which may be properly called excise duties are the duties on spirits, beer, tobacco, chicory, and the passenger receipts of railway companies, but many imposts have been classed (probably for greater convenience in collection) under the head of duties which are not (as before stated) properly in the nature of excise. In 1908 the power to levy duties on local taxation licences was transferred from the Board of Inland Revenue to the County Councils. In that year it was provided by Order in Council that, subject to certain exceptions and modifications, from January 1, 1909, every County Council in England and Wales shall have, within its county, all power and duties formerly vested in the Board of Inland Revenue for carrying into execution every enactment relating to duties on licences to deal in game, and licences for dogs, killing game, carrying guns, for carriages, armorial bearings, and male servants.

In the United States the word excise has no official meaning, the analogous term there being "internal revenue," which is chiefly derivable from the taxes imposed on whiskey, tobacco, and malt liquors. There are also taxes on banks, etc., but stamps ceased to be a source of revenue after 1883.

Exciter, in *Electricity*, is an instrument for the production of electrification generally at high potential. Such instruments are usually designed on the principle of electric induction (q.v.).

Excommunication, an ecclesiastical punishment in Christian churches of being cut off from the privileges of church membership. It was a very real punishment in former days, when, in the case of private persons, the state enforced or allowed the penalties which it entailed, but modern views have made it only a spiritual penalty. Modern churches claim the right of exercising the power of excommunication; but it is a question how far, in states where the sovereign is the nominal head of the Established Church, the ecclesiastical authorities can go of their own motion. A clergyman exercising his supposed right of refusing communion to a parishioner is liable to a legal action.

Excretion, a term applied to material elaborated by the various glands of the body, and separated by them from the blood, and cast off as being of no further use in the animal economy. [SKIN, KIDNEY, etc.]

Exe, a river of Devonshire formed by the junction of two streams flowing from Exmoor, and uniting on the border of Devon. It flows S. past Exeter, and forms an estuary at Exminster. The river is not navigable so far as Exeter.

Execution has several meanings in law:—

(1) *Execution in Civil Process* is issued by a

Court of Justice to enforce its judgment, and the Writ of Execution (which is the last stage of a suit) is given to the successful party either to put him in possession of the thing in dispute or to enable him to recover the debt or damages awarded him by such judgment. For this purpose—in the High Court—a writ issues out of the division of the court in which the judgment is recovered, in the name of the sovereign, addressed to the sheriff of the county in which the property is situate or the person against whom the process issued resides, commanding him to give possession of the property or (as the case may be) to levy on the person's goods or tenements for the amount recovered in the action; upon receiving this writ, the sheriff issues his warrant to his officers to carry out the same.

The Writs of Execution are as follow:—(1) The Writ of Capias ad Satisfaciendum (to arrest the body), the use of which writ out of regard to the liberty of the subject has been of recent years very much curtailed. [CAPIAS.] (2) The Writ of Fieri Facias against the goods and chattels. [FIERI FACIAS.] (3) The Writ of Elegit against the lands generally of judgment debtor. [ELEGIT.] (4) The Writ of Habere Facias Possessionem against the particular lands or premises recoverable in the action. (5) In Detinue (which is an action brought for recovery of goods detained) there is a special writ of execution for recovery of the goods themselves, or their value, with damages and costs. By 23 and 24 Vic., c. 38, Writs of Execution on judgments are required to be registered in order to affect lands as against *bona fide* purchasers for valuable consideration, and no judgment affects lands until such lands shall have been actually delivered in execution by virtue of a Writ of Elegit or other lawful authority, and such Writ of Execution must be registered.

In the County Courts the process, though different in form, is much the same in effect. When the judge at the hearing adjudges a sum of money to be paid by one party to another by instalments or otherwise, and the order for payment is not complied with, execution may issue against the goods of the judgment debtor, and if such debtor has the means to pay at the date of the judgment, or at any time afterwards, and fails to do so, he may, on his ability being established to the satisfaction of the judge, be committed to prison for any period not exceeding forty days, though he may obtain his liberty at any time by paying the sum ordered. Also the execution upon a judgment of one County Court against the debtor within the district of another County Court in England may be effectuated by such latter Court, provided such latter Court have received and duly sealed with its own seal the warrant duly attested of the first County Court to proceed to such execution. Also if a judge of the High Court is satisfied that the debtor has no goods or chattels convenient to satisfy the judgment obtained in the County Court, he may order a Writ of Certiorari to remove the judgment into the High Court for the purposes of execution against his lands or otherwise. Furthermore, by the "Inferior Courts Judgments Extension Act, 1882," the judgment of a County Court in England

may be executed in any other part of the United Kingdom by the corresponding Court in such other place, provided a certificate of the judgment be first registered in such other corresponding Court.

2. *Execution of Criminals* is another and more painful signification of the word. It is performed by the proper legal officer, the sheriff or his deputy. The Common Law mode of execution is by hanging, which until the year 1868 took place in public; but in that year an Act was passed directing that the execution must take place within the walls of the prison, in presence of the sheriff, gaoler, chaplain, and surgeon of the prison, and such other officers of the prison as the sheriff requires. An Act of Parliament of Queen Victoria's reign provides for suspension of execution in the case of a lunatic.

3. *Execution of a Decree.* Sometimes from the neglect of parties, or some other cause, it becomes impossible to carry a decree of a Court of Justice into execution without the further decree of the Court upon a bill filed for that purpose. This happened generally where parties having neglected to proceed upon the decree, their rights under it became so embarrassed by subsequent events that it was necessary to have the decree of the Court to ascertain and settle them. Such a Bill might also be brought to carry into execution the judgment of an inferior Court of Equity, if the jurisdiction of that Court was not equal to the purpose, as in the case of a decree in Wales which the defendant avoided by going into England.

4. *Execution of Deeds.* [DEEDS.]

5. *Execution of Wills.* [WILLS.]

Executive Government is that part of the sovereign power in a country which carries out the sentence of the judicial authorities, or the resolutions and acts of the legislative power. The Crown and the officers appointed by it for the above purposes form the Executive Government in England.

Executor is one to whom another commits the execution of his last will or testament. The origin of executors appears to be traceable to a constitution of Manuel Commenus. All persons capable of making a will, and some others, as married women and infants, are eligible to be made executors, but infants are incapable of acting in that capacity till they attain full age.

An executor derives his authority from the will alone. If no executor be appointed by the will, administration is granted with the will annexed, and administrator is bound to obey the directions of the will. An executor may decline to act; but, having once acted, he cannot divest himself of the office or its liabilities; nor can an administrator who has accepted the office get rid of his responsibility.

The first business of an executor is to prove the will, which is now done in the Probate, Divorce, and Admiralty Division of the High Court at the principal or one of the District Registries. Formerly this jurisdiction was vested in the Ecclesiastical Courts. [ECCLESIASTICAL COURTS.]

The Court furnishes the executor with a document known as "the Probate" containing an engrossment of the will and copy of the grant of Probate. The original will is deposited in the Registry of the

Court, and may be inspected in office hours on payment of a search fee of 1s. An executor may do many acts in execution of the will before Probate, as paying and receiving debts, etc.; but he cannot before Probate sustain actions or suits. An administrator can do nothing till the grant of letters of administration. [ADMINISTRATION.]

If an executor happens to die before grant of Probate, administration must be taken out to his testator, with the will annexed; but if an executor die after having probate of will granted to him, his executor will be the executor and representative of the first testator, unless, before proving the will of second testator, he renounces the execution of the will of the first. If the executor should die intestate, his administrator is not the representative of the original testator, but an administrator "*de bonis non*" (that is, of the goods unadministered) of the original testator must be appointed. Should there be several executors, the office survives, and is transmitted ultimately to the executor of the surviving executor, unless he dies intestate. Executors have a joint and entire interest in the effects of their testator; any one of them is capable of acting by himself or herself and the receipt for a debt or the transfer of property by one is as effectual as if made by all.

If a *stranger* acts as executor without authority, he is termed an executor *de son tort* (in his own wrong), and he has all the liabilities of an executor without any advantages. But the only advantage which an executor practically derives from his office is his right to retain any debt due to him from the testator, as against creditors of equal degree to himself.

The duties of executors and administrators are generally the same and comprise the burying of the deceased, the proving of his will (if any), the getting in his goods and chattels to pay his debts in the order appointed by law, and also his legacies, if any, and to distribute the residue of his goods and chattels in the manner directed by the will, or according to the statutes for the distribution of the effects of intestates, in case of there being a total or partial intestacy (q.v.).

In like manner as the rights of a bankrupt pass (with certain exceptions) to the trustee, so upon the death of either of the parties between whom a cause of action founded on contract has arisen, the right of maintaining such action survives in general to or against his executors or administrators. In respect, however, of actions founded on certain violations of personal rights—as, for instance, slander—the maxim is that they *die with the person*, and this formerly extended to every case of tort as distinguished from contract. But (except with reference to causes of action for violation of personal rights, such as assault, slander, and the like) this ancient rule has been now set aside by various Acts of Parliament; for by 4 Edward III., cap. 7, actions may be maintained by executors and administrators for trespasses to the *personal* property of their testator or intestate, and by 3 and 4 William IV., c. 42, sec. 2, for any injury to his real estate provided such injury was committed within six calendar months before and the action is brought within one year after his death,

and by the last-named statute actions may be maintained against executors or administrators for any wrong committed by the deceased to another in respect of property either real or personal, provided the wrong was committed within six calendar months preceding the death and the action be brought within six calendar months after the executors or administrators have taken upon themselves the administration. As to compensation to families of persons killed by accident, see "CAMPBELL'S ACT."

Executory and Executed Consideration.

The consideration for a contract (like the contract itself), may be either *executed* or *executory*, and its character in this respect is determined by the relation which its performance bears in point of time to the promise as being either prior or subsequent. Thus, if I bail a man's servant, and the master afterwards promises to indemnify me, this is an executed consideration; but if a man promises to indemnify me in the event of my bailing his servant, the consideration is then executory. And with regard to an executed consideration the rule is, that if it were not at the express or implied precedent request of the promiser, but a mere voluntary contract, it will not suffice to support a promise. Therefore, in the first example, the promise would not be binding in law unless the bailing were at the master's precedent request. [CONTRACT, CONSIDERATION.]

Exegesis is the interpretation of the Scriptures, and at the present day covers the whole field of Biblical criticism, literal and doctrinal.

Exeter, a city, seaport, parliamentary (one member) and municipal borough, capital of Devon, on the left bank of the Exe, about 10 miles N. of the English Channel, and on the Great Western Railway. It is built on the top and sides of a hill sloping down towards the river, which is crossed by a stone bridge at the western entrance of the town, which consists of two main streets at right angles with others branching from them. Much of the town is very ancient, but there are modern terraces and villas, which are daily increasing as the educational advantages of the town make it desirable as a residence. The cathedral is cruciform, and is 408 feet long, with two Norman towers 130 feet high. The choir is 128 feet long, and there are 10 chapels, and a chapter-house. The architecture of the west front is everywhere admired. There is much Norman work in the different churches of the city; and parts of the old Saxon walls remain, and the ruins of the castle of Rougemont. The free grammar school has 16 exhibitions to Oxford or Cambridge, and there are libraries, museums, a diocesan training college, a hospital, etc. Formerly, Exeter was a seat of the woollen trade, but this industry is now extinct. There are iron-foundries, agricultural implement works, paper-mills, corn-mills, and tanneries, and some manufactures of gloves and lace. There is a basin to which ships of 400 tons have access by means of a canal 5 miles long. The town was an old British station before being the *Iscia Damnoniorum* of the Roman times. Many coins, statues, and fragments

of pavement have been discovered. The Saxons called it Monktown for its many ecclesiastical establishments. Pop. (1901), 46,940.

Exhibitions (Latin *exhibere*, to shew, display) are public displays, generally of art or industries or productions. Their number and kind are many; but the most noted are the series of Industrial Exhibitions, inaugurated in England at the instance of the late Prince Consort in 1851. This has been followed by many, in all countries, England, France, America, etc. The French Exhibition of 1889 was in commemoration of the centenary of the Revolution, and was rendered famous by the well-known Eiffel Tower.

Exile, in the ancient Greek states, arose as a means of evading the penalties of homicide implied by the blood feud. Voluntary withdrawal of the offender was legally recognised, and (in the case of wilful murder) involved formal outlawry and confiscation of property. By Solon's laws, political indifference during civil conflict was similarly punished at Athens. [OSTRACISM.] Under the Roman Republic, though there was no formal penalty of exile, the "interdiction of fire and water" (and of certain civil rights which they symbolised) within certain limits of Rome, was practically its equivalent (*Cicero*). Under the emperors it was replaced by "deportation to an island" (usually a very small one, such as Patmos or those near Elba), which involved loss of property and citizenship, but not of freedom. A milder form of exile, "relegation," did not involve these consequences, and either confined the person to certain places, or excluded him from them. Thus Ovid was "relegated" to Tomi. The punishment, as implied in outlawry, has existed under Continental governments, but its most important application at present is in Russia. Here it is a means at once of getting troublesome persons well out of the way, and of colonising remote, wild, and unprotected parts of the empire. So for three centuries the system has flourished and extended with every circumstance of barbarity, corruption, and stupidity. But to-day—thanks partly to the recent tragic events in Kara and Yakutsk, and partly to the investigations of George Kennan, which supplemented and substantially confirmed the statements of native writers like Maximoff and Yadrintseff, and of the revolutionists Stepniak, Krapotkin, and Volkhovsky—it is generally condemned as bad alike for the exiles themselves and the communities amid which they are settled. Since 1823, whence the statistics date, about 800,000 exiles have crossed the Urals; and during the last fifteen years the annual average has increased to about 17,000. These include all manner of offenders, from the mere vagrant who has lost his passport and the peasant who has offended the village authorities, to the hardened ruffian who would get short shrift were capital punishment in vogue. Of the whole number, little more than half have received even the semblance of a trial, and many of these only after long preliminary detention. The others have been sent on simple "administrative order," a method which became common in the case of political suspects in Alexander II.'s later years. The

journey to Siberia, though much lightened, is still a terrible ordeal, especially for the sick, and for the women and children who are allowed to accompany the prisoners into exile. Twenty years ago the gangs of fettered convicts with their military escort had to tramp the whole distance from Moscow—4,700 to 5,200 miles—a march occupying from two to three and a half years. Now, however, there is rail and water communication as far east as Tomsk, and the journey on foot is reduced by one-half. About 330 miles is made per month, there being a halt for rest every third day. Each prisoner receives five cents a day for food. Most of the forwarding prisons and *étapes* are regularly and scandalously overcrowded, so that typhus, scurvy, typhoid, and syphilis work havoc, and the sick and death rates are almost incredibly high. There is seldom separate accommodation for the sick, and everywhere the degradation of the few gentle and innocent by the many strong and brutal goes on in the foul *cameras* where they are promiscuously herded together. The journey ended, the body of exiles resolves itself into two main classes: the imprisoned or hard-labour convicts, numbering about one-third of the whole number, and those merely banished to a certain area with more or less close surveillance. The first class are sent mainly to the Czar's mines in Trans-Baikalia or Nerchins or to the island of Saghalien, on the Pacific Coast; and for some time a good deal of convict labour was also used in the construction of the Siberian railway. The second class, which includes most of the political and religious offenders, are scattered all over the country, and many of them break away at once and join the floating criminal population which swarms along the great roads of Siberia, and which is credited with two-thirds of all the crimes that are committed there. The lot of the "politicals" is never a happy one. They are forbidden to teach, to trade, and "generally to exercise any public activity," and as the Government allowance is only about twelve shillings per month, a bare subsistence is difficult. Many are now sent to the wild Mongolian frontier and to the sub-arctic Yakut country, where they have to live in the filthy *yourts* of the natives. What this means is indicated by the fact that, of 79 politicals in Yakutsk in 1882, Kennan found that six had committed suicide before 1885. Still this may be preferable to the terrors of prison life at Kara or Saghalien. Three special commissions have condemned the exile system, and Mr. Galkin Wrasskoy, the chief of the prison administration, presented a plan for its radical alteration to the Imperial council in 1888. It was rejected, probably on financial grounds; but it is almost certain that a rational prison system would be cheaper in the long run. [KARA, KENNAN, SAGHALIEN, SIBERIA, VOLKHOVSKY.]

Exine, the outer coat or exospore of the pollen-grain (microspore) of flowering plants, formerly known as the extine. Smooth in the pollen of self-pollinating and wind-pollinated flowers, in insect or bird-pollinated ones it is often furnished with spinous (echinulate) or ridge-like projections. In *Pinus* it is produced into two reticulate-marked

air-bladders. It is either simply burst or slashed to permit the protrusion of the pollen-tube in germination, or little lid-like portions of it may be pushed off.

Exmoor, a forest occupying part of the S.W. of Somerset and extending into Devon. Part of it is now cultivated, but the greater part is wild heath, marsh, and moss. The surface is varied, and there are some considerable heights, the greatest being Dunkerry Beacon (1,668 feet). Of late some iron mining has been carried on. The Druids seem to have held the spot in esteem. *Lorna Doone* has familiarised most people with the main features of the district, and many tourists search out and visit the Doone Valley, the Badgery woods, and the Slide. Whyte Melville has also illustrated the region in *Katterfelto*. The red deer still runs wild here, and stag-hunting has been followed for centuries.

Exmouth, a town of Devon, on the left bank of the Exe estuary, 10 miles S.E. of Exeter, situated in a gap of the cliff. It is now a fashionable seaside resort, and has a good sandy beach well suited for bathing. In the time of Edward III. it was a flourishing port. The industries are fishing and lace-making. Pop. (1901), 10,487.

Exmouth, VISCOUNT. [PELLEW.]

Exocetus. [FLYING-FISH.]

Exodus (Gk. *ex*, out, *hodos*, way) is the name given by the Septuagint translators to the 2nd book of the Pentateuch, since it is mainly occupied with the account of the departure of the Israelites from Egypt, with the events that immediately led up to and followed it. The authenticity of the book has been much questioned, and in the matter of arithmetic and of details it has met with considerable adverse criticism.

Exogamy. [MARRIAGE.]

Exogens, a name formerly applied to the class Dicotyledons (q.v.) among angiospermous plants, with which were included the gymnosperms, since they agree in the growth of their stems in thickness being exogenous—that is, in a general sense external, taking place, as it does, through the activity of the cambium (q.v.), which, though under the bark, is external to the wood of the stem.

Exophagy. [CANNIBALISM.]

Exosmose. [ENDOSMOSE, OSMOSE.]

Expansion means increase of dimension in one, two, or three directions. We thus have linear, areal, or voluminal expansion. Heat is a general cause of expansion for most materials, a definite increase in temperature of the substance being associated with a corresponding increase in its dimensions. The term *coefficient of expansion* is hence applied to the proportional increase in dimension of a body per degree rise in temperature. Such expansion by heating must be allowed for in practice, and inasmuch as most solids expand with great force the effect may be rendered useful in many applications. The expansion of an iron girder bridge on a hot day may amount to three or

four inches or more, and provision must therefore be made to render such expansion free. The walls of a building that are in danger of falling outwards may be drawn together by iron bars that are expanded by heating and then allowed to cool and contract; the iron tires of wheels are fixed on when hot, so as to bind the parts of the wheel more tightly together when cold; the expansion by undue heating of metals in close neighbourhood of each other may bring them into actual contact, and by so doing set up an electric circuit and ring an alarm bell [ELECTRIC BELLS]; and many other practical applications of extension by heating might be cited. But indiarubber, and in certain states sundry other materials, do not expand on heating but suffer contraction. [HEAT.]

Expectorants (from two Latin words signifying, out of the chest), drugs which promote the secretion of the mucous membrane of the air passages—*e.g.* *Ipecacuanha*, *senega*, *squills*, etc.

Explosion. In pure chemistry the term explosion is given to a change of condition of a chemical system, which, once initiated, is quickly propagated through the system with the evolution of energy, and without the supply of external energy. The term is, however, generally applied to any sudden bursting of a body, usually owing to the rapid generation of large quantities of gas, though in some cases, as in boiler explosions, owing to gradually increasing pressure from the interior. Explosions are usually initiated by a flame or sudden concussion. In the latter case rapid impact of a small mass is more efficacious than that of a more slowly moving larger body. In some cases a particular form of vibration can cause the explosion; thus iodide of nitrogen placed on a vibrating string explodes when a certain rate of vibration is reached. Many substances are dependent on some resistance for their explosion, merely burning quietly if the gases can pass freely away. In such cases the slightest possible resistance, as a sheet of paper, may be sufficient to convert the harmless combustion into a dangerous detonation. Explosions in coal mines have long attracted much attention, but some doubts still exist as to the chief cause. They are usually ascribed to the *marsh gas* (fire-damp) CH_4 in the mine, but it has been shown that the ignition of fine dry coal dust alone is sufficient to cause an explosion, just as flour dust has given rise to explosions in flour mills. The cause of the work done by the explosion of a substance, such as gunpowder, is the very rapid evolution of large quantities of gases, which would occupy in the substance mentioned, under ordinary conditions, about 300 times the space taken up by the powder itself, while owing to the high temperature it has been estimated that the pressure, when the powder entirely fills the space in which it is fixed, rises to 6 or 7 thousand atmospheres. The velocity of explosion—*i.e.* the rate at which the changes are propagated through the system, and its dependence upon the external physical conditions—has been the subject of much experimental work, though owing to its nature it offers great difficulty to accurate experiment.

Explosives. The term is in general applied to such substances, either mixtures or free compounds, which can suddenly, owing to some external impulse, give rise to large volumes of gas. The impulse may be given either by a flame, a sudden concussion, electric spark, or other means. In most cases of ordinary explosives the gases are formed owing to the oxidation of some of the constituents, the explosive itself containing in some of its ingredients the oxygen necessary for the oxidation. The energy of the explosion depends, *inter alia*, upon the rate with which the chemical change can be propagated, and hence, as would be expected, owing to the greater proximity of the molecules, it is generally greater in the case of explosives which are compounds than in those which are mixtures. The oxygen is usually present in the form of a nitrate, chlorate, or in the group NO_2 , the latter being especially the case with explosive organic compounds. Some of the principal explosives in ordinary usage are the various varieties of *gunpowder*, *gun-cotton*, *nitro-glycerine*, and *dynamite*, *fulminate of mercury*, and preparations of *picric acid* (such as *melinite*, *lyddite*, etc.); and explosives obtained from these compounds. During late years also attention has been given to experiments upon flameless explosives, more especially for use in coal mine blasting. A common mode is the enclosure of the explosive in a water cartridge, but some substances have been prepared which themselves explode with the production of no flame. As examples there are *Roburite*, *Bellite*, and *Securite*, consisting of mixtures of di-nitro-chlor-benzene or di-nitro-benzene with ammonium or other nitrate. For estimating the strength of an explosive, the following points are the chief to be considered:—(1) the quantity of gas produced; (2) the temperature; (3) the rapidity of evolution. In the case of gunpowder the explosive pressure has been both estimated and measured, with but little difference in the results; but in the case of the stronger explosives it has been hitherto practically impossible to measure their strength. The power of the commoner explosives compared for equal bulk has been computed as follows:—

Nitro-glycerine	-	-	-	-	-	100
Dynamite	-	-	-	-	-	74
Gun-cotton	-	-	-	-	-	60
Blasting powder	-	-	-	-	-	17.5

One of the tests often employed is the effect in smashing iron plates when exploded upon their surface. Another is to explode the substance in a small cylinder provided with a form of piston, and measure the compression of a lead plug placed under the piston. Various other methods have been adopted, but none are at all satisfactory. It is unnecessary to state that the manufacture of explosives is one which requires the greatest possible care and precaution, while the sale is regulated by stringent legal acts, etc. [See separate articles on the explosives mentioned.]

Exponents, in algebra, are the indices or powers to which various quantities are raised. Thus if a quantity x is to be raised to the seventh power it is written x^7 , the 7 being the exponent.

The theory of indices shows the general extension of such exponents to fractional and negative values. [INDICES.]

Extension means a drawing out. Geometrically, the extension of a substance is regarded as a strain and the cause is called stress. Such may be produced by the direct application of mechanical force, and this expenditure of energy is measured by the product of the force and the extension produced. Thus in the case of mere elongation or extension in one direction only, the product of force and the change of length measures the work done and, therefore, the energy expended. Similarly for extension in two dimensions, the force per unit length multiplied by the change in area gives the work done; and for extension in three dimensions the force per unit area multiplied by the change in volume measures the energy expended. In the case of expansion due to heating we are thus able to measure the heat required to effect this expansion, and can conclude that unless the substance is itself changed the heat energy given to it is measured in the above way.

Extine. [EXINE.]

Extortion is an offence in abuse of the administration of justice, and consists in any official unlawfully taking by colour of his office from any man or woman any money or thing of value that is not due to him, or more than is due, or before it is due. The punishment for this offence, which is a misdemeanour, is fine and imprisonment at the discretion of the court, and sometimes a forfeiture of the office. There are also various statutes providing penalties for extortion by sheriffs, under-sheriffs, bailiffs, gaolers, clerks of assize, etc.

Extracrinus, a genus of sea-lilies, or Crinoides, to which belong some of the best known English fossil species, usually assigned to *Pentacrinus*.

Extracts. There are several forms of extract in the British Pharmacopœia; thus the active principle of a drug may be extracted with water, alcohol, ether, or, as in one instance—that of the *extractum colchici acetici*—with dilute acetic acid.

Extradition. Where a person who has committed a crime in one country quits that country for another, and is delivered up by the latter to the former for the purpose of trial, this is known as extradition. At Common Law there was no jurisdiction of this kind, and to remedy this state of things several Acts of Parliament have been passed. The duty of a state to make extradition of criminals is by no means generally admitted, and it is considered an exercise of comity only; generally speaking, no state willingly allows an extradition of its own subjects, and no state will decree an extradition of political offenders. The existing procedure of England in regard to the extradition of criminals is regulated by the "Extradition Acts, 1870 and 1873," which provide that when an arrangement for that purpose has been made with any foreign state, the Sovereign may, by Order in Council, direct that the Act shall apply in the case of such foreign state, subject to such conditions as

may be expressed in the order. But the former Act (1870) makes an express exception of political offences, the Secretary of State having it in his discretion to decide whether the offence is or is not of a political nature. The Act of 1873 extends provisions of the principal Act to the case of accessories punishable as principals.

Extravasation (from the Latin, escape from a vessel), a pouring out of the contents of a blood-vessel into the surrounding tissues.

Extreme Unction, one of the seven Sacraments of the Catholic Church. It consists in the anointing by the priests of the channels of the five senses, accompanied by prayers that all sins of which they have been the means may be forgiven. The Greek Church makes a more frequent use of it in disease than the Roman Church, which reserves it for cases of mortal sickness. (James v. 14.)

Eyam, a Derbyshire village, 5 miles N. of Bakewell, chiefly made famous on account of the outbreak of the plague there in 1665, and the heroic conduct of the rector, William Mompesson, who devoted himself to his parishioners, two-thirds of whom perished. An interesting *History of the Plague at Eyam* has been published.

Eyck, JAN VAN (d. 1441), also called Van Brugge, a noted Netherland painter. He was taught by his brother, whom he soon outstripped. The family dwelt chiefly at Bruges, but in 1420 he, with his brother Hubert and sister Margaret (also a painter), went to Ghent to paint for the cathedral there a picture of the *Adoration of the Lamb*. This was on wood, with side panels, and contained 300 figures. Jan was also court painter to Philip the Good of Burgundy, and utilised his court surroundings for filling in the details of his pictures. His brother and sister both died before the picture was finished, in 1432, after which he returned to Bruges, and remained there till his death. He was one of the encouragers of oil painting, and was very successful as a painter on glass, and did much to introduce perspective into painting. His faces, colouring, and grouping are good, but the deficient anatomical training of the day is visible in the extremities. Among his pupils are said to have been Albert Dürer, Hans Memling, and Holbein.

Eye. *Anatomy of the eyeball.* The eyeball is nearly spherical. Its outer coat is, excepting the transparent anterior portion (*cornea*), known as the *sclerotic* (from a Greek word signifying "hardness"), the sclerotic being composed of dense connective tissue. Into this coat the muscles which effect the movements of the eyeball are inserted; they are six in number; four pursue a straight course, and are known as the (*recti*), superior, inferior, external, and internal; the two remaining muscles are the superior and inferior oblique muscles. Covering the anterior portion of the sclerotic, and reflected over the inner surface of the eyelid, is the *conjunctiva* (q.v.). The posterior portion of the hollow of the skull in which the eyeball is situated (*orbit*) contains fatty tissue which serves as a packing material for the eyeball. Piercing the bony wall

of the back of the *orbit* and inserted into the posterior portion of the eyeball is the *optic nerve*.

The various coats of which the eyeball is composed are seen on reference to the annexed figure. The outer protecting coats, *sclerotic* and *cornea*, have been already alluded to. Within these are

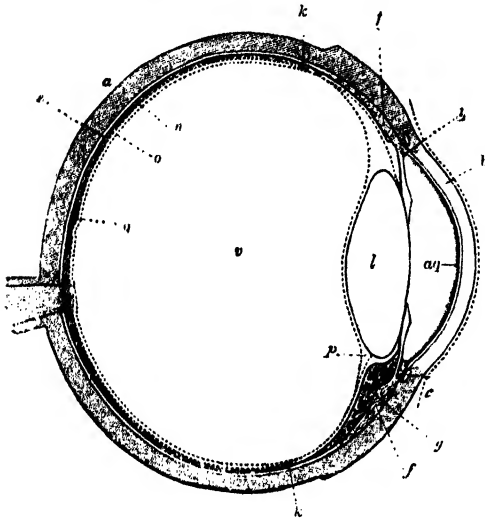


Fig. 1.—SECTION OF THE HUMAN EYE.

a, Sclerotic coat; b, cornea; c, conjunctiva; e, choroid coat; f, ciliary muscle; g, ciliary processes; h, iris; i, optic nerve; k, boundary of retina; l, crystalline lens; a, choroid pigment; o, retina; q, yellow spot of retina; ag, aqueous humour; r, vitreous humour.

found, first the middle coat, comprising the choroid, iris, and ciliary processes, and innermost of all lies the *retina*. Further, it is seen that within the globe of the eye there lie three transparent media—(1) the *aqueous humour*, occupying the *anterior chamber*; (2) the *crystalline lens*, and (3) the *vitreous humour*. The aperture in the *iris* seen through the transparent *cornea* is known as the pupil of the eye. The *iris* being composed of muscular fibres, the size of the pupil varies with the state of contraction and relaxation of these fibres. Under the stimulus of light the pupil becomes small, while on entering a dark room it undergoes dilatation. The portion of the eye which is immediately concerned with the translation of the undulations of light waves into the phenomena of vision is the *retina*. The structure of this membrane is exceedingly complex. Suffice it to say that the portion of the retina which the waves of light are supposed to directly influence is the *rod and cone* layer, seen at the upper portion of the figure, and that these *rods and cones* are supposed to be in direct connection with the terminal fibres of the *optic nerve*, and that through these fibres they communicate the disturbance caused by the action of light upon them to the brain. The said *optic nerve*, after piercing the several coats at the back of the eye, radiates outwards, forming an

expansion, lining the entire inner surface of the *retina*. In the figure these fibres are represented by the transverse lines depicted at its lower portion.

The eyelids are two folds composed of skin externally, conjunctiva internally, while between these is a supporting framework of cartilage, the *tarsal cartilage*, and a series of muscular fibres. Closure of the eyelids is effected by the contraction of a muscle, the *orbicularis palpebrarum*, which surrounds them, while the upper eyelid is raised by the contraction of another muscle, the *levator palpebræ*, which is inserted into the *tarsal cartilage*.

In the upper and outer part of the *orbit* is situated the *lacrimal gland*, the secretion of which is poured out through a number of minute

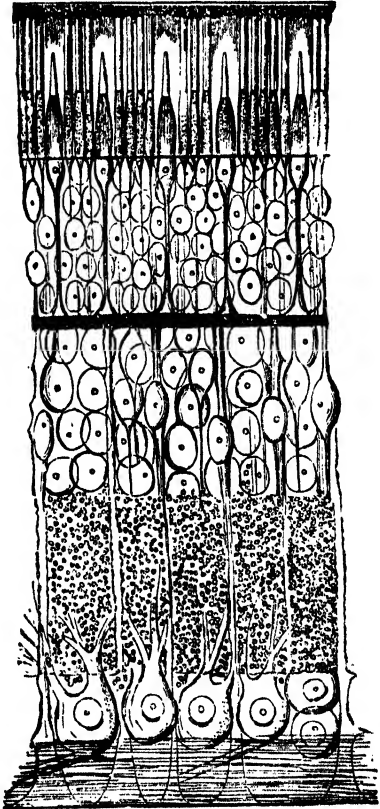


Fig. 2.—SECTION OF THE HUMAN RETINA (SEMI-DIAGRAMMATIC SEEN UNDER A HIGH MAGNIFYING POWER).

ducts, washes over the anterior surface of the eye ball, and escapes at the inner angle of the eye by two minute openings, the *puncta lacrymalia* which open into two canals, the *lacrimal canals* which in turn open into the *lacrimal duct*, by means of which the tears are carried downwards into the nasal cavity. The motor nerves of the externa muscles of the eyeball are the third, fourth

and sixth cranial nerves. The fourth nerve supplies the superior oblique muscle, the sixth nerve the external rectus muscle, and all the remaining external muscles of the eyeball are supplied by the third nerve.

The internal muscles of the eyeball are, firstly, the muscles of the *iris*, which are supplied by a branch of the third nerve and by the sympathetic, and secondly, the *ciliary muscle*. It is this last-named muscle which is concerned in the *accommodation* of the eye for seeing near objects. The muscle arises anteriorly from the junction of the cornea and sclerotic, and passes backwards to be inserted into the choroid. It should be mentioned that the lens is maintained in its position by a suspensory ligament, which is attached to the anterior portion of the choroid. When the ciliary muscle contracts, the choroid in the neighbourhood of the point of attachment of the lens is drawn forwards, the suspensory ligament is relaxed, the tension which it exercises on the elastic lens diminishes, and the latter bulges forwards. The refractive power of the lens is thereby increased. The rays of light from distant objects are, of course, parallel, and the normal eye is so adapted that they are exactly focussed on the *retina*. It follows, then, that the divergent rays which proceed from near objects would, unless some change in the refracting mechanism of the eye occurred, be focussed behind the *retina*. The altered convexity of the anterior surface of the lens, brought about by the relaxation of the suspensory ligament above alluded to, increases the refracting power of the eye and brings the divergent rays to a focus upon the *retina*. This is the way in which the *accommodation* of the eye for near objects is brought about.

To return to the *retina*, it should be noted that a small portion of that membrane only is concerned in the formation of distinct images of external objects. This spot is the *yellow spot* or *fovea centralis*, and in order that the said images may be accurately focussed upon the *yellow spot* in each eye, it is necessary that the eye should be so directed by the muscles as to bring this about. Hence the convergence of the eyes when looking at a near object. Another part of the retina which demands attention is the point

invisible: on approaching a little nearer to the figure, or again on receding from it, the circle will be seen to come into view. The invisibility of the circle when the head is held at the appropriate distance is due to the fact that its image falls upon the *blind spot* of the *retina*. By proceeding in a similar manner with Fig. 3, B, the same phenomenon can be demonstrated in the case of the left eye.

Diseases and injuries of the eye. For diseases of the conjunctiva, cornea, iris, and retina, see special articles, CONJUNCTIVITIS, KERATITIS, IRITIS, and RETINITIS. The chief disease of the lens is cataract (q.v.); glaucoma is also dealt with under a special head. [For the subject of squint, see STRABISMUS.]

It remains to discuss sympathetic ophthalmia errors of refraction, injuries of the eye, and diseases of the eyelids and lachrymal apparatus.

Sympathetic ophthalmia is a term applied to inflammation affecting an eye occurring consecutively to injury of the other eye. It is only certain forms of injury which are apt to be followed by sympathetic affection of the uninjured eye. Punctured wounds, especially when they involve the "ciliary region" (that is, the portion of the sclerotic immediately outside the cornea, and lying over the site of attachment of the ciliary processes), are particularly dangerous in this respect. In cases where an injury of this kind has occurred the question arises whether it is not advisable to remove the damaged eye. Where the injury has produced considerable loss of vision it is generally considered to be necessary to effect this removal without delay. If, however, the puncture has been a clean one and but little loss of vision has resulted, an attempt is sometimes made to preserve the injured eye, but such cases need the most careful watching and are always cause for much anxiety. The onset of *sympathetic ophthalmia* is so insidious as to elude the observation of any but the most careful observer. The earliest symptoms of the disease are watering of the eye, avoidance of light, and slight loss of vision. These slight evidences of inflammatory mischief gradually become more and more marked, and result in destructive inflammation of the iris and ciliary processes, leading, it may be, to complete loss of sight.

Errors of refraction. Certain structural defects in the eye interfering with the focussing of images upon the retina must be considered under this head. It should be premised that the arrangement which obtains in the normal eye is such that the parallel rays which proceed from distant objects are (when the ciliary muscles are not in action) accurately focussed on the retina; while the divergent rays from near objects are brought to a focus on the retina by the contraction of the ciliary muscle (accommodation). Such an eye is called an *emmetropic eye*. Two deviations from this normal condition must now be alluded to. In the *hypermetropic* (or *long-sighted*) eye the parallel rays from distant objects are brought to a focus (when the accommodation is at rest) behind the retina, so that, for accurate vision, the ciliary muscle must be already brought into play to a certain extent



Fig. 3, A.



Fig. 3, B.

of entrance of the *optic nerve*. At this spot the *rods* and *cones* are completely absent, and this part of the retina does not transmit to the brain any image which may be thrown upon it; it is therefore called the *blind spot*. The existence of this *blind spot* can be readily verified by reference to the annexed figure; thus, for the right eye, close the left eye and hold the right some 10 or 12 inches above the cross in Fig. 3, A, and steadily regard the same. The white circle will then be found to be

even for distant objects. A still further effort on the part of the ciliary muscle is called for when such an eye has to deal with the divergent rays from near objects. In the *myopic* (or *short-sighted*) eye parallel rays are focussed in front of the retina, and as a consequence no clear image of them can be obtained. Rays of a certain degree of divergence are focussed exactly upon the retina, and in the case of still more divergent rays some slight effort at accommodation becomes necessary for accurate definition. The excessive use of the ciliary muscle in hypermetropia (long-sight) causes it to become hypertrophied, and the muscular strain gives rise to certain symptoms. Of these headache is one of the most prominent, slight catarrhal affections of the conjunctiva are also common in the subjects of hypermetropia; and, again, this condition if allowed to continue unrelieved sometimes produces convergent squint. This last-named phenomenon is explained by the fact that accommodation and convergence are naturally associated with one another in looking at near objects, and if the accommodation be unduly exercised a corresponding abnormal exercise of the muscles which produce convergence is the consequence. Hence the importance of dealing with hypermetropia from the outset. The strain upon the ciliary muscle is obviated by the use of convex glasses of suitable strength. The lenses used should be of such power, that with relaxed accommodation parallel rays are brought to a focus upon the retina. The selection of the proper glasses is a matter demanding considerable care, and the patient's own notions as to what glass suits him should by no means be trusted. Indeed, it is sometimes a matter of difficulty to persuade the subject of hypermetropia that he requires to use any glasses at all. In young children the condition is very apt to be overlooked altogether until some serious complication, such as squint, develops.

In myopia (short sight), on the other hand, the inability to see distant objects generally causes the nature of the mischief to be sufficiently obvious. Here concave glasses must be used in order to focus parallel rays upon the retina. Myopia usually declares itself in growing children, and unless remedied proceeds from bad to worse, sometimes with considerable rapidity. In the more serious cases of progressive myopia, inflammatory mischief in the choroid coat of the eye is apt to supervene.

Astigmatism is the condition in which the refracting media are not equally powerful for rays in different meridians; thus, for instance, rays in a vertical plane may be brought more quickly to a focus by an astigmatic eye than rays in an horizontal plane, or *vice versa*. In such a condition a luminous spot is not seen as a circle, but as an oval; one set of lines may be seen clearly, but another set, at right angles, appears blurred. This condition must be remedied by the use of cylindrical glasses.

Presbyopia is an affection of advancing years, and is due to a gradual failure of accommodating power, due, it is said, to diminishing elasticity of the lens substance. In presbyopia distant vision is not in any way impaired, but for the distinct

focussing of near objects convex glasses require to be employed. The ordinary history of a case is that when the age of 45 or 50 is attained a difficulty is experienced in reading, sewing, and the like. A lens of slight convexity at once obviates this difficulty, but as age advances stronger and stronger glasses have to be employed.

Injuries of the eye. The intense irritation caused by the presence of a foreign body beneath the eyelid is a familiar experience to all. Such intruding substances are particularly apt to lodge beneath the upper lid. Sometimes the simple expedient of raising the lid by holding the eyelashes between the finger and thumb, and then drawing the upper lid down over the lower lid, suffices to dislodge the particle which is the cause of the trouble. In other instances it is only when the upper lid is everted that the foreign body can be detected and removed. The lodgment of particles on the surface of the cornea may necessitate the use of an instrument (corneal spud) for their removal. The operation is much facilitated by benumbing the sensation of the cornea by the use of cocaine.

The dangers associated with penetrating wounds have already been discussed.

Diseases of the eyelids. A *stye* is a small boil affecting the edge of the lid. It usually points to an impaired general condition of health, and in such a state one stye is apt to succeed another, and the trouble is at times very obstinate and intractable. Warm fomentations, poultices, and measures directed with a view to improving the health of the patient are indicated.

Tarsal cysts and meibomian cysts are due to obstruction at the orifice of one of the Meibomian glands of the eyelid. Secretion accumulates and produces an unsightly localised swelling in the lid, for the effectual removal of which it is necessary to make a small incision on the inner surface of the lid, and through this incision to scrape out the contents of the cyst.

Blepharitis is an inflammatory affection of the margins of the lids which is not uncommon in children. Attention to cleanliness, the application of yellow oxide of mercury ointment, and the administration of tonics, speedily effect a cure.

For ectropion and entropion see special articles.

Diseases of the lachrymal apparatus. Obstruction in the passages which convey the tears from the surface of the eye into the nasal cavity causes the lachrymal secretion to flow over the face (watering of the eye, *epiphora*). The condition is generally relieved by the performance of the small operation known as *sitting up* the canaliculus. Obstruction in the nasal duct or lachrymal sac should on no account be neglected, as it may lead to the formation of a lachrymal abscess. If this should be the case the matter will require to be evacuated, and much pain and annoyance are associated with such a condition.

Eyeglass. [SPECTACLES, OPTICS.]

Eye-piece. [TELESCOPE, MICROSCOPE.]

Eyo (Iju), the dominant people on the Nun branch of the Niger delta, Gulf of Guinea; their territory extends west to Yorubaland, east to the

Old Calabar river, and north to the Benin country, and their chief tribal divisions are the *Akasas* at the mouth of the Nun; the *Nempé* of Brass about the New Calabar river; and the *Okrika* of Bonny still farther west. The *Nempé* are the most active and powerful of these negro peoples, and their dialect has become the standard form of Eyo speech. It has been reduced to writing by the English missionaries, and now possesses an extensive religious literature; but most of the tribes are still nature worshippers, and even the nominal Christians continue to practise pagan rites. Amongst the local gods are monkeys, the shark (New Calabar), and the iguana (Bonny estuary). The "Jew-Jew men," or magicians, also retain much of their former influence as medicine men, priests, soothsayers, and judges. The ordeal by poison prevails, the *esséré*, or Calabar bean (*Physostigma venenosum*), being much employed for this purpose. It was thus that the Europeans became acquainted with the potent properties of this plant, which is now found to be efficacious in the treatment of ophthalmia. All the Eyo tribes are keen traders, and the "Bonny men" especially enjoy a well-earned reputation for their shrewd business habits.

Eyre, EDWARD JOHN (1815-1901), was born in Yorkshire. Emigrating young to Australia, he became a squatter and magistrate, and in 1841 headed an exploration of Central and Southern Australia. He was afterwards Governor of New Zealand, and was appointed Governor of Jamaica in 1862, and in 1865 he was attacked, recalled, and prosecuted, John Stuart Mill joining in the action. His opponents could not make out their case, and he was paid the costs of his defence, but he was not further employed by the country.

Ezekiel, the third of the Hebrew greater prophets, was a priest, son of Buzi, and was one of those carried away to Babylon in 599 B.C. By the river Chebar inspiration came to him to speak and reveal to the people the sufferings that came for their idolatry, and to announce to them a future end of their captivity, a return and restoration of prosperity, and a union of Israel and Judah. He also denounced the neighbouring nations. His words are vigorous and poetical, but their full sense is veiled.

Ezra, a Hebrew scribe and priest, descended from Aaron, high priest of the Jewish captives in Babylon, and the guide and ruler of the second expedition of return from Babylon to Palestine. He was looked on in some sort as a second Moses, since he refounded the nation and settled the canon of the Scriptures. He is said to have introduced the square Hebrew character, and to have been the author of the Books of Chronicles, Ezra, Nehemiah, and Esther.

F

F, the sixth letter of the English as of the Chalcidian and Latin alphabets [ALPHABET] is derived from the Phœnician *Fau*, which probably is

taken from an Egyptian hieroglyph representing the horned asp or cerastes. It appeared in Greek as the digamma, which, however, was soon lost in most Greek alphabets, and occurs only in early inscriptions, and as the numeral for 6. The Roman F had probably the English sound, whereas the Greek digamma was probably a W or intermediate between that and V. In Anglo-Saxon and in Welsh F has the sound of V, the modern F sound being represented by ff.

Faber, THE REV. GEORGE STANLEY, born near Bradford, Yorkshire, in 1773, graduated at University College, Oxford, and, taking holy orders, became Prebendary of Salisbury and master of Sherborn hospital, Durham, in 1831. He was the author of several learned and pious works, now out of date, such as *Horæ Mosaicæ*, *The Mysteries of the Calvary*, *The Difficulties of Infidelity*, and *The Difficulties of Romanism*. He died in 1854.

Faber, THE REV. FREDERICK WILLIAM, often called "Father Faber," a nephew of the foregoing, was born at Culverley in 1814, and educated at Harrow and Balliol College, Oxford, winning the Newdigate Prize in 1836. After holding a fellowship at University College and the living of Elton, Hants, until 1845, he joined the Church of Rome under Newman's influence. He spent some years in Birmingham, but in 1849 established the Oratory in London, where he ministered until his death in 1863. His hymns, the best of which are *The Pilgrims of the Night* and *The Land beyond the Sea*, have made his name famous in all the churches.

Faber, JOHN, "the Hammer of Heretics," was born in Suabia about 1475, entered the Dominican order, distinguished himself by his zealous opposition to Luther, became confessor to Ferdinand I., and Bishop of Vienna, where he died in 1541.

Fabians, or **FABIAN SOCIETY**, a Socialist organisation, started in London in 1883, in order to spread information tending to the abolition of private property in land and of capital vested in other hands than those of the community. Branch societies have been established in provincial towns, in several British colonies, and in New York. The name is presumably derived from the advocacy of a "Fabian policy" [FABIUS, Q. M. V.]—i.e. they hope that capitalism will wear itself out, and that circumstances will inevitably bring about the "socialisation of industry." The work of revolutionising public opinion is carried on by means of lectures and publications, such as *Fabian Essays* and *Fabian Tracts*.

Fabius, the gentile name of one of the most illustrious patrician families of ancient Rome, was supposed to be derived from *Faba*, a bean. According to legend, the whole kith and kin, with the exception of one lad, was destroyed by an ambush near Cremera in the war against the Veii (477 B.C.). From this youth sprang the historical Fabii, who were divided into eight branches, the Ambusti and Maximi being the most important.

Fabius, QUINTUS (MAXIMUS RULLIANUS), attacked the Samnites in 323 B.C., contrary to the

orders of the Dictator Papirius, and won a victory. The dictator would have put him to death, but the soldiers interceded. This Fabius held the consulship five times, and was twice dictator.

Fabius, QUINTUS (MAXIMUS VERRUCOSUS), surnamed "Cunctator," great-great-grandson of the foregoing, and the most illustrious of his race, became consul in 233 B.C., when he triumphed over the Ligurians. After the capture of Saguntum he was at the head of the memorable embassy to Carthage. In 217, when the Carthaginian victory at Thrasymene jeopardised the existence of Rome, he was named dictator or (according to one reading in Livy) prodictator, and by his temporising strategy wore out at last the vigour of Hannibal till the re-conquest of Tarentum turned the tide of war. After five consulships he handed over his power to a worthy successor, Scipio Africanus, and died in 203 B.C., having nearly attained his hundredth year.

Fable, a story with a didactic purpose, in which animals, plants, or inanimate objects behave as human beings. On the whole, it differs from a parable in that its significance is moral not spiritual; and from the allegory, in that the moral lesson it teaches is given as a corollary rather than intermingled with the story. The fable, moreover, is essentially short and pithy, and the "moral" can be expressed in a single sentence. Beast fables (q.v.) illustrating some simple moral proposition occur among most primitive peoples, and are the product of a time when animals were commonly credited with such human attributes as intelligence and the power of speech. But (though it is difficult to draw a precise line), it may be said that the fable is generally a pure invention with a didactic purpose; the myth (q.v.) a growth, believed in as truth. The fables best known in Europe probably originated in Hindustan, and were introduced into Europe through Greece. Æsop, to whose invention most of those current in Greece were ascribed, lived, according to Herodotus, in the 6th century B.C., but, though accounts of his life exist, they are probably mere inventions. Metrical versions of fables—the invention of the plots of which was attributed to him—existed in Greece under the name of Babrius (q.v.), and in Latin under that of Phædrus (q.v.). They have come down to us under his name in prose. Lessing has eulogised the short and pithy style of Æsop, but it is probable that this is due to their having been turned from verse into concise and rather bald prose, to serve as a first reading-book for children. There are a few original Roman fables, but as a rule the fables of Æsop, Phædrus, the Sanskrit Hitopadesa, and the early mediæval writers indicate a community of origin. Some of the latter are probably due to the Crusaders. When the fable was taken up as literature, numerous fables were written, sometimes in conscious imitation of Æsop, in Germany and France, and in our own day in Russia. The names of La Fontaine and Kriloff will at once suggest themselves, and there were many German fabulists in the 17th and 18th centuries. Lessing, attacking these fabulists for deserting the simple directness of Æsop in favour of a flowery style, wrote a series

of fables (in which the moral is left to inference) as concise as those ascribed to Æsop, and an essay on the fable, in which he argues that a fable differs from a simile or illustration in being the story of a concrete case, from which, however, a general moral can be inferred. He insisted that the fable should be moral, not merely satirical, in its significance. He also discussed the reason why animals are the usual personages in fables. Partly, he concluded, it is because they have definite and well-marked characteristics; partly because our attention is not diverted from the moral by human sympathies as it would be were the characters living beings. This view doubtless attributes too much deliberate invention to the earliest fabulists; and moral conclusions are now mostly so trite that it may be doubted whether any attempt to enforce them by stories such as Lessing's can be very successful. Possibly political satire may again employ the fable, but for its use in moral teaching the time has passed.

Fabliaux (Latin *fabula*, story), in French literature, short satirical tales in verse, almost always in octosyllabic couplets, usually satirising classes, e.g. women, knights, or monks, often with great licence of expression. They were mostly composed between 1150 and 1350, and were part of the stock-in-trade of the wandering minstrels. Some were derived from classical sources, some from the East through the Crusaders, some probably indigenous. They were the source of most of the Italian prose tales of the 14th or 15th centuries, and Chaucer's *Canterbury Tales* have been termed perfect fabliaux.

Fabricius, CAIUS LUSCINUS, one of the types of early Roman statesmanship and morality, rose to the consulship in 282 B.C. Two years later when Pyrrhus was encamped before Tarentum, he was sent to him as an envoy, and resisted all the corrupt offers of the king, whose esteem he further won by denouncing the proposition of the royal physician to poison his master. He defeated the league of Samnites, Lucani, and Bruttii, that had joined Epirus against Rome. His frugality was so great that at his death he left nothing to pay for his funeral or provide for his daughters, and during his censorship he excluded Rufinus from the senate because he possessed 10 lbs. weight of silver.

Fabricius, or FABRIZIO, GIROLAMO, called "Aquapendente" from his birthplace, was born in 1537, and became a famous professor of anatomy in the university of Padua, where Harvey was his pupil. His discovery of the valves of the veins led to the latter's theory of the circulation of the blood. He died in 1619.

Facade (Ital. *facciata*, from *faccia*, face), the front of a building, usually of one with some pretensions.

Facciolati, JACOPO, was born at Torriglia, near Padua, in 1682. He was trained for the priesthood, and became director of the Paduan seminary, but his chief bent was towards classical philology. He re-edited the *Lexicon* of Schrevelius and the *Ciceronian Dictionary* of Nizolius, and with the help of Forcellini brought out the *Calepino*, a

vocabulary of seven languages. His monumental work, *Totius Latinitatis Lexicon*, was completed by Forcellini after his death. He was for some forty years Professor of Logic in the university of Padua, where he died in his 88th year.

Facial Palsy (BELL'S PALSY). This is one of the commonest forms of local paralysis affecting a special motor nerve, viz. the seventh cranial nerve, or facial nerve. The following are the symptoms of the affection:—The muscles of the face on the paralysed side cannot be put in action by an effort of the will, and, moreover, they no longer present the condition of tonic contraction which is natural to them in the normal state apart from their being specially called into play. Thus the natural lines of expression are lost, the naso-labial groove is obliterated, the mouth is drawn upwards on the unaffected side, and the furrows on the forehead are less marked on the paralysed side. The condition of things becomes plainly manifest when the patient attempts to laugh, to close his eyes, to frown, and the like. Bell's palsy may be due to disease of the facial nerve, originating in any part of its course. It is most commonly produced by exposure to cold, or it may arise as a complication of ear disease (the nerve in its course through the temporal bone being specially exposed to involvement where aural mischief is present). Treatment consists in the application of the electrical current. [ELECTRICITY, MEDICAL.]

Factor, in mathematics, means any number which will divide into another without remainder. The number 36 may be produced by the multiplication of 3 and 12; 3 and 12 are said to be factors of 36; so also 9 and 4 are factors of the same number. In fact, any number that will divide exactly into 36 is a factor of 36. There are numbers that are divisible only by unity, such as 7, 11, 13, 17, 19, 23, and so on. Such are termed *prime* numbers.

Factory Acts. The word factory, according to the original Factory Act (7 Vic., c. 15), means all buildings wherein steam, water, or other mechanical power is used to work any machinery employed in the manufacture of cotton, wool, hair, silk, flax, hemp, jute, or tow.

The Legislature has interfered to prevent children in factories being tasked beyond their strength to the permanent injury of their constitutions. This abuse was the more to be dreaded because a large number of the children engaged in cotton-spinning were not directly employed by the masters, but were under the control of the spinners, a highly-paid class of workmen, whose earnings depended greatly upon the length of time during which they could keep their young assistants at work.

As early as the year 1832 a parliamentary committee sat for the investigation of this subject, and subsequently a commission was issued by the Crown for ascertaining by examination at the factories themselves the nature and extent of the abuses which prevailed, and for suggesting the proper remedies.

The following is a short enumeration of the important recent Acts of Parliament which have been passed, and under which factories are now

regulated and controlled, and their several objects. The "Factory and Workshop Act, 1878," contains 107 sections and 6 schedules, and consolidates, with a few amendments, the seventeen preceding Acts, commencing with that known as "Addington's Act," passed in the 42nd year of the reign of George III., up to the 37th and 38th Victoria (the "Factory Act, 1874"). By these several statutes the labour of women, young persons, and children has from time to time been regulated, the education of children indirectly obtained, and the fencing of machinery prescribed. This Act was amended as to white-lead factories and bakehouses by the "Factory and Workshop Act, 1883," and generally by the "Factory and Workshop Acts, 1891, 1895, 1897, and 1901." By these latter Acts the powers of factory inspectors are increased, means of escape from fire are directed to be provided, and the employment of children under eleven years of age, and of women within four weeks after childbirth, is prohibited. Moreover, by section 24 ('91 Act) weavers in the cotton, worsted, or woollen, or linen, or jute trade, if paid by the piece, are entitled to have supplied to them "particulars to enable them to ascertain the rate of wages at which they are entitled to be paid."

The use of steam whistles for summoning or dismissing factory hands requires the sanction of local authorities by 35 and 36 Vic., c. 61.

Faculæ are bright streaks visible on the surface of the sun. They are more obvious near the edge of the disc, the photosphere showing up less brilliantly. Faculæ are simply heaped up masses of the luminous matter forming the photosphere, and may be sometimes recognised as such when passing round the edge of the sun's disc. They are generally abundant in the neighbourhood of sun-spots. [SUN.]

Faculties, COURT OF. A *Faculty* is a privilege or special dispensation granted to anyone by favour and indulgence, authorising him to do that which by strict law he could not do—for example, to marry without the previous publication of banns; to hold two or more ecclesiastical livings at the same time, and the like. A faculty is very frequently required and granted for special alteration in the church or churchyard (sec. 32 and 33 Vic., c. 94). The *Court of Faculties* is a jurisdiction or tribunal belonging to the archbishop. It does not hold pleas in any suits, but creates rights to pews, monuments, and particular places and modes of burial. It has also various powers in granting such licences as are above referred to.

Fadel (properly ULED-FEDÂLA), a historic Berber tribe of Algeria, province of Constantine, south-west of Batna; occupies the wooded slopes of the Aures mountains, where rises the Wed-Fedâla, an affluent of the Biskra named from this tribe. The Fadels are mentioned by El-Bekri (11th century), and were formerly very powerful, but are now reduced to less than 2,000 souls.

Fæces, the excrementitious matters discharged by animals from the lower bowel. The average amount of fæces eliminated by the human adult in the course of twenty-four hours is six or eight

ounces. The composition of the fæces is about three parts of water and one part of solids. The latter consist of the more insoluble parts of the food which have resisted the action of the digestive juices (e.g. particles of cartilage, woody tissue, muscular fibre, etc.); of mucus and epithelial scales; of mineral salts; of various substances derived from the bile; and of certain specially named constituents (excretin, stercorin, etc.).

Fæd, THOMAS, the son of an engineer, was born at Burley Mill, Kirkcudbright, in 1826. As a child he showed an aptitude for painting, and in 1841 was able to begin a course of study in Edinburgh, where he exhibited successfully many charming pictures in water-colours and oil. In 1852 he settled in London, being then an associate of the Royal Scottish Academy, and in 1864 he became a Royal Academician. Among his numerous and popular works may be mentioned *The Motherless Bairn*, *Home and the Homeless*, *Walter Scott and his Friends at Abbotsford*, *The First Break in the Family*, *The Last of the Clan*, and *The Shepherd's Wife*. He retired from his Academicianhip in 1893. He died in 1900. His elder brother, Mr. JOHN FÆD, was an artist of great merit in the same line, and his *Cotter's Saturday Night*, *Soldier's Return*, *Stirrup Cap*, *John Anderson*, *My Jo*, and *Gamekeeper's Daughter*, hardly fall short of the standard attained by his younger kinsman. He died in 1902.

Faenza (ancient *Parentia*), a town of Italy, 20 miles S.W. of Ravenna. It is said to have given the name "faience" to the glazed and ornamented earthenware that was first made there about the close of the 13th century, but it is a curious coincidence that Faience in France was very early the seat of the same industry. The town possesses a citadel, a cathedral, and several interesting churches. It is the birthplace of Torricelli, the physicist.

Fagging, a custom prevalent at some of the older English public schools, including Eton, Harrow, Westminster, Rugby, and Winchester. Boys below a certain form or class in the school are obliged to perform in rotation for the upper boys such offices as cooking their breakfasts, cleaning their studies, running errands, or long-stopping at cricket. Possibly originating in the rule of the strongest (though scholars also to some extent were at the beck and call of the fellows in the earliest Oxford colleges), the practice, though very carefully regulated, is maintained from a regard to tradition, and even defended as a useful discipline. It is not, however, imitated at the newer schools.

Fahrenheit, GABRIEL DANIEL, was born at Dantzic in 1686. He devoted himself to physical researches, and by substituting mercury for spirit in the thermometer, as well as by basing a new scale upon carefully conducted experiments, he rendered a great service to science. Fahrenheit was elected fellow of the Royal Society in 1724, and his scale has generally been adopted in England. His death took place in 1736.

Fahrenheit Scale of temperature, the scale generally adopted in England, is that which was

introduced in 1714 by Fahrenheit. The temperature of melting ice is called 32°, and that of water boiling at ordinary pressure is called 212°, there being a range of 180° between these two fixed points on the scale. The temperature of 0° Fahr. is approximately that of a mixture of pounded ice and salt, and was so chosen because that was the greatest intensity of cold then known. The Centigrade scale has certain advantages, and has partially superseded the Fahrenheit. [HEAT, TEMPERATURE.]

Faidherbe, LOUIS LÉON CÉSAR, born at Lille in 1818, entered the French engineers, and served with distinction in Algeria, Guadeloupe, and Senegal, of which latter colony he was governor from 1854 to 1870. The Provisional Government recalled him after the fall of the Empire to take command of the Army of the North in its gallant but futile struggle against the German invader. He won a victory over Manteuffel at Bapaume towards the close of the year, but early in 1871 sustained a crushing defeat at St. Quentin. When peace ensued he was sent on a mission of a nominally scientific character to Egypt and the Soudan. *Le Soudan Français* was the result of this expedition, and several other works of interest on the languages, antiquities, and natural features of North Africa have come from his pen, besides an account of his campaign in France. He died in September, 1889.

Fainéants, ROIS (from Fr. *faire néant*, do nothing), a term applied to the effete Merovingian (q.v.) kings, who abandoned their authority to their mayors of the palace.

Fainting, and **SYNCOPE**, are terms applied to the condition produced by a sudden disturbance of the heart's action or of the distribution of the blood within the body, resulting in a diminished supply of blood to the brain and other parts. The symptoms of syncope are pallor of the skin, especially noticeable in the face, often accompanied by sweating and associated with coldness of the extremities; the pulse becomes weak; the respiratory movements are slow and feeble; a feeling of nausea is almost always present, and actual vomiting may occur. There is also more or less complete loss of consciousness, and the patient may suddenly fall to the ground in a state of complete insensibility. Syncope may be caused by disease of the heart or other organs of the body, but fainting attacks are not infrequently produced by mere emotional disturbance, or by exposure to a close and unhealthy atmosphere. Treatment consists in causing the patient to assume the recumbent posture or inducing him to sit with the head brought well forward between the knees, so as to encourage the gravitation of blood to the cranial cavity; in loosening clothing over the neck and chest to allow free play for the movements of respiration; in applying stimulant aromatic substances to the nostrils or dashing a little cold water over the face or chest; and in administering some form of stimulant such as brandy or sal-volatile.

Fairbairn, SIR WILLIAM, F.R.S., was born at Kelso, N.B., in 1789. After being educated as an

engineer at Newcastle-on-Tyne, he started business in Manchester at the age of eight-and-twenty. He directed his attention to the use of iron for construction, and, having been successful in several minor experiments, began in 1835 to build iron ships. His experience aided Stephenson in the carrying out of the Menai tubular bridge. Among many technical works he wrote *Iron: Its History and Manufacture, The Application of Iron to Building Purposes, and Iron Shipbuilding*. One of the originators of the British Association, he became its president in 1861, received the medal of the Royal Society. He was a chevalier of the Legion of Honour, and was created a baronet in 1869, dying in 1874. His brother, Sir Peter, and his nephew, Sir Andrew Fairbairn, have been eminent as manufacturers and public men at Leeds, and his son, Sir Thomas Fairbairn, was an authority on matters of art and on the labour question.

Fairfax, EDWARD, an English poet, who flourished about 1600, in which year he published his metrical version of Tasso's *Jerusalem Delivered*, a work that received the praise of Waller, Dryden, and James I. He was also the author of a *History of the Black Prince* in verse and a prose treatise on *Demonology*.

Fairfax, SIR THOMAS, afterwards LORD, of the same family as the foregoing, was born at Denton, Yorkshire, in 1611. His father, Lord Fairfax, sent him to Cambridge, but he preferred arms to books, and went to Holland as a volunteer under Lord Vere, whose daughter he married. A strong Presbyterian, he espoused the popular cause in the Civil War, and after presenting to the king a petition on Heyworth Moor begging him not to raise an army, he received the command of the cavalry under his father, who had control of the northern forces. At first he was no match in Yorkshire for the Earl of Newcastle, but when he raised the siege of Nantwich, fortune turned in his favour, and he effected a junction with his father and with the Scots, by the side of whom he fought at Marston Moor (1644). In that year he was severely wounded in attacking Helmsley Castle, and the fact increased his popularity. January, 1645, saw him appointed commander-in-chief in place of Essex, with Cromwell as his lieutenant. Together they won the battle of Naseby, and crushed out the Royalist spirit in the western counties. He was now so completely under Cromwell's influence that he severed himself from the Presbyterians to support the more violent Independents. In 1647 he was Constable of the Tower, and in 1648, having succeeded to the title, he held command at the siege of Colchester. He was appointed one of the king's judges, but took no active part in the proceedings. When the Scots took up arms in 1650, he declined to march against them, resigned his command, and retired into private life until 1659, when he joined Monk and seized York for the reactionary party. He subsequently served on the committee despatched to the Hague for the purpose of bringing back Charles II. The last eleven years of his life were spent at his home in Yorkshire, where he wrote an account of his public career and

several minor works, dying in 1671. He left no son, the title devolving upon his cousin.

Fairies, or ELVES, a collective name for certain supernatural beings that figure largely in European folk-lore. They are conceived as having human forms, but are generally, though not invariably, pictured as of diminutive size. The word *fairy* really means enchantment, the work of the fays—the term *fay* (Fr. *fée*, from Low Lat. *fata*) being originally used in Latin tongues to express the idea conveyed by *elf* in the Teutonic languages. But though this etymology rests on evidence, there is also a folk-etymology which ascribed “their most frequent name to their being a *fair* or *comely* people, a quality which they affected on all occasions, while the superstition of the Scots [who called them *fair-folk*] was likely enough to give them a name which might propitiate the vanity for which they deemed the race remarkable, just as they called them ‘men of peace’ and ‘good neighbours.’” This quality, too, served to distinguish them from the dwarfs and gnomes, who were conceived as dark and swarthy. The notion of fairies seems to have been originally Celtic, and to have sprung from the nature-deities of Gaul, memories of which still survive in Brittany. But to this original notion the nymphs and fairies of classic times and the darker mythology of northern Europe contributed their share. According to Scott, fairies may “be described by negatives, being neither angels, devils, nor the souls of deceased men.” They were supposed to dwell, under the government of a king or queen, in a land of enchantment. Their pageants and court festivities were gallant and splendid. The fairies were young and beautiful, dwelt in stately halls, enjoyed boundless wealth, rode on spirited horses, and hunted with hawks and hounds far surpassing those of earth. But all was illusion: when beheld by the eye of a seer the delights of this fairy elysium vanished, and the knights and ladies became wrinkled old men and hideous hags, just as the Lamia resumed her true serpentine form when looked on by one who knew her secret. Their pleasures were showy but unsubstantial, their activity unceasing, but fruitless; and their condemnation appears to have consisted in the necessity of maintaining the appearance of constant industry or pleasure, without deriving reward from the one or enjoyment from the other. Fairies were credited with carrying off children; and this was accounted for by the belief that they were bound to pay a yearly tribute to the Devil, and not unnaturally preferred to satisfy him with the children of men, whom they carried off and in whose place they left their own puny offspring. Unbaptised infants were alone liable to be taken by the fairies; but adults, when engaged in certain unlawful deeds, might, even though baptised, be carried off to fairyland. On this superstition Scott's ballad of *Alice Brand* is founded, and it is worth careful study, for it is a compendium of fairy lore. In the Arthurian legend fairies play an important part: it was said that Camelot was “a city of enchanters built by fairy kings,” and that Arthur was a

"changeling out of fairyland
Who drave the heathen hence by sorcery
And Merlin's glamour."

If the prologue to the *Wife of Bath's Tale* is to be taken literally, the belief in fairies was on the wane, and the fairies themselves were banished by the friars in Chaucer's day. But any scepticism that existed must have been confined to the learned, and the fairies evidently came back; for in the 17th century Corbet, Bishop of Norwich, in his *Fairies Farewell*, tells us that they had just gone, owing to the New Faith. Neither friars nor New Faith, however, entirely drove out the old paganism, for even at the present day there are spots in Britain where fairies are occasionally seen; and in the south and west of Ireland many a farmer whose cattle do not thrive will consult the fairyman (that is, one who has dealings with the fairies), rather than the veterinary surgeon.

Fairs (Lat. *feriæ*) are temporary assemblages of traders, differing from markets in being held only once a year, or at longer intervals, and being on a much larger scale. They probably grew up from the assemblages of traders attending religious festivals or political assemblies, the two being in early civilisation often identical. Traders are known to have assembled periodically from all parts of the civilised world at Tyre and Sidon; we hear also of their presence at the Greek games at Olympia, Delphi, and Corinth; while at Rome every ninth day (*nundinæ*), or, as we should count it, every eighth day, was the market day and day of assembly, and in a sense a religious festival. In Roman Britain there are some traces of fairs, and in the Anglo-Saxon period they also existed, probably accompanying political assemblages as at Rome. After the Norman Conquest the right of holding them was only conferred by royal grant, and in return for payment. It was often granted out to religious houses, who were authorised to maintain the fair on their own land, preserving order and levying tolls. Special courts of pie powder (*piods poudrés*, dusty-footed, i.e. pedlars' or travellers' courts) were held for the trial of disputes arising at these fairs. Foreign traders were admitted to most of them, and freed at them from the various oppressive restrictions (e.g. as to responsibility for one another's debts) which ordinarily hampered them. Among celebrated fairs in England, Stourbridge or Sturbridge Fair, just outside Cambridge, was the most famous. The privilege of holding it was given by King John to the master of the Lepers' Hospital at Cambridge, but the town and the University, in consequence of its extreme importance to them, had also certain rights of control over it. This fair was one of the most important in Europe. It lasted for three weeks from Sept. 18. Its importance as a horse and cattle fair lasted later than that of its other functions; but it gradually lost its importance in the 19th century. Daniel Defoe has left a striking description of it in his *Tour*. Winchester Fair was of even more importance in the Middle Ages, as being near Southampton, the emporium of south-eastern trade. It was under the control of the bishop, and lasted for sixteen days from St. Giles' eve. Boston. St. Ives, Stamford, Oxford,

Abingdon, and Nottingham had also important fairs. The dramatic booths, such as "Richardson's Show," and the various shows including giants, dwarfs, and other monstrosities, were naturally a prominent feature of these fairs. St. Bartholomew's Fair, popularly called Bartlemy Fair, in Smithfield, London, dates from 1133. In the 19th century it gradually declined, and complaints of the immorality it engendered caused the City Corporation in 1839 to refuse to let any more stands for shows. In 1843 these were prohibited altogether, and the tolls generally were raised. In 1850 the fair was intermitted, and in 1855 the last was held. Indeed, the decay of fairs, owing to the better means of communication and development of commerce was one of the notable features of English economic-history in the 19th century. Shorn of their commercial importance they were resorted to chiefly for the purpose of revelry, and were the meeting-place of bad characters, while they came to interfere with the trade of resident dealers. The complaints of their immorality caused measures for their restriction early in the reign of Queen Victoria. Thus 2 and 3 Vict., c. 37 (1839) authorised the holding of inquiries in London (within the metropolitan police district) as to the title to hold any fair, and if the title were not satisfactory the police were authorised to remove the booths, subject to the trial of the right in the Court of Queen's Bench on appeal to it by the alleged owner of the fair. In 1871 an Act was passed reciting that whereas certain fairs are unnecessary, are the cause of grievous immoralities, and are injurious to the inhabitants of the towns where they are held, the Secretary of State, on the representation of the magistrates in Quarter Sessions, and with the consent of the owner, might order any fair to be abolished. But horse and cattle fairs, cheese fairs, and hiring fairs for engaging farm servants, are still carried on in various parts of Great Britain.

Among foreign fairs, the great fair of Troyes, in Champagne, which was of much importance as early as Charles the Great's reign, gave its name to "Troy weight"—as the foreign coins naturally in circulation at it were reduced to a common denomination according to that standard. During the Crusades a great fair was held annually in September on Mount Calvary; it was attended largely by Venetian traders, and was one of the chief means by which Eastern goods reached Europe. The fairs of Rouen, Lyons, St. Denis, and St. Germain, near Paris, were celebrated among French fairs, as were those of Leipzig and Frankfurt in Germany. The book fair at Leipzig has only recently been superseded by modern methods of conducting the bookselling trade. The great fair of Nijni Novgorod in Russia, covering altogether some seven or eight square miles, and increasing the population of the town fivefold while it is held, is the last and largest survival of the mediæval fairs. Goods of the value of £10,500,000 are said to have been offered for sale there in 1849. Most modern visitors, however, have been somewhat disappointed with the fair, which Russians extol as one of the wonders of the world; but the variety of nationalities collected at it

makes it remarkable. Fairs obviously belong to an early stage of commerce, and will probably soon everywhere be extinct. As a means of exhibiting goods they are replaced by the International Exhibition, to which the term is commonly applied in America; as a means of selling them, by the advertisement, the agent, and the commercial traveller, not to speak of the world-wide "connexion" which belongs to great modern producing firms. In America the term is often applied to local agricultural and other exhibitions (*e.g.* a "state fair") and to charitable bazaars, of which the "Sanitary Fair," held at New York in 1863 in aid of the wounded during the War of Secession, is an instance on a large scale.

Fairy Rings, circles of dark-green coarse grass in lawns and pastures produced by the centrifugal growth of the spawn or "mycelium" of various kinds of fungi. The fairy-ring champignon (*Marasmius orcadus*) and the St. George's mushroom (*Agaricus gambosus*), both valuable as food, are among the commonest species that grow in this manner. The soil within the ring is impoverished, that immediately beneath the ring being temporarily enriched by the decaying crop of fungi. The mycelium dying at its centre while it increases centrifugally, the rings increase in each successive season. Besides the popular explanation that they are caused by the elves dancing in a ring, there have been various other attempts to account for them.

Faith, in Christian theology, usually means the assent of the soul to the promises of God and the revelation of His will coupled with the confidence that He will perform His promises. The term thus expresses both acceptance of a system of doctrine and confidence in a Person; and besides intellectual assent, it involves a special state of the emotions and direction of the will. As assent to a system of doctrine, it is often contrasted with reason. Reason draws a conclusion from premises, faith (it is said) deals with and accepts a conclusion which is beyond the reach of unaided human reason, but certified by a kind of inward revelation.

Faith Healing, a religious movement for the curing of disease by prayer and laying on of hands, which arose independently at Mainendorf, in Switzerland, and Motlingen, in the Black Forest, between 1850 and 1860. In the former case, Dorothea Trudel, an artificial flower-maker, in the latter Pastor Blumhardt was the originator. The movement spread into Sweden and America, and from the latter country into England, where houses for the treatment of sickness by this method have been established, called "Bethshan" ("house of safety"). A similar belief is held by a small English sect, the Peculiar People (*q.v.*). It is based on a passage in the Epistle of St. James (*v.* 14). The cures, analogous to those effected by hypnotism (*q.v.*), and perhaps at some Roman Catholic places of pilgrimage—*e.g.* Lourdes—are in part susceptible of a rationalistic explanation. Confidence is well known to be a powerful auxiliary to cure, and it is probable that some at least of the illnesses cured may be put down to hysteria.

Faithfull, EMILY, the daughter of a clergyman, was born at Headley Vicarage, Surrey, in 1835. She began very early to take an interest in the various questions that are included under the head of "Women's Rights," devoting herself particularly to the fostering of independent industries for women of the working class. With this view she started in 1860 a printing press in which female labour only was employed. The Queen patronised her scheme, and later on conferred a pension upon its originator. Besides many contributions to the press, Miss Faithfull was the author of a novel, *Change upon Change*, that met with considerable success a quarter of a century ago. She delivered many lectures, too, upon the subject of her life's work, and thrice visited America for the purpose of making known her principles. She died in 1895.

Fakir (Arabic *fakir*, beggar), properly a member of a mendicant Mohammedan religious order, devoted to contemplation and contempt of this world. Strictly, therefore, the term is identical in significance with Dervish (*q.v.*), but in India the term is applied to any religious mendicant, though these are mostly Mohammedans. There are many orders of them. They are often half-insane, and not unfrequently impostors; but are maintained by a certain love of idleness, buffoonery and storytelling, which is a feature of many Eastern countries. Of the fakirs of India, some (the Mudaria) are often jugglers, or have performing bears or monkeys; some (the Sohagia) dress like women, play, sing, and dance; others (the Kafai) cut and wound themselves apparently without inconvenience; others beg at night only, carrying a lamp (Kaye and Watson: *Peoples of India*). There are cases on record, apparently well authenticated, in which fakirs have been buried alive for a considerable period at their own request.

Falashas, an Abyssinian people, who form a compact body in the province of Semen, about the head-waters of the Takazzé, but who are also found in scattered groups in all the surrounding districts as far south as the Abai (upper course of the Blue Nile). They are commonly known as the "Jews of Abyssinia," and there can be no doubt that they have practised Jewish rites from time immemorial, certainly long before the Christian era. But although they claim to be of the "House of Israel," and call themselves "Israel," they are not Jews or Israelites, but Hamitic aborigines of Abyssinia, closely allied in speech and physical appearance to the Agao of Lasta, and other indigenous populations. At least, if the Falashas, that is "Exiles," really represent the lost tribes, as some suppose, then it must be allowed that in the course of ages these Semites have become transformed to Hamites, both in their language and physical appearance; in these respects they are not distinguishable from the Hamitic element that forms the substratum of the inhabitants of Abyssinia. [ABYSSINIA.] M. d'Abbadie, while admitting the assimilation, still holds that they may have sprung from a Jewish colony that reached Abyssinia at the time of the Babylonian captivity, and in any case it is evident, from the widespread diffusion of the Hebrew religious, that

a considerable number of Jews must have penetrated to the plateau in remote times. Their gradual absorption amongst the surrounding population would present no difficulty, for similar results have been witnessed under similar conditions in many other regions. In their upland homes the Falashas are chiefly occupied with agriculture; but large numbers yearly emigrate to Gondar and other places, where they find employment as masons, woodcutters, water-carriers, workers in iron, and such-like pursuits. None of their teachers have any knowledge of Hebrew, and their Bible is written in the Gheez, or ancient Himyaritic, which is also the liturgical language of the Abyssinian Christians. (Ant. d'Abbadie in *Nouvelles Annales des Voyages*, iii.; Stern, *Wanderings among the Falashas*, 1862; Beke, *On the Languages of Abyssinia*; Halévy, *Bull. de la Soc. de Géographie*, 1869.)

Falcon, any bird of the genus *Falco*, type of the family Falconidæ (q.v.), with twenty-seven species, universally distributed, except in the Pacific Islands. They are distinguished by the short, stout beak, very distinctly toothed, well-marked, generally yellow cere, long, pointed wings, and long, rounded tail. The outer toe is longer than the inner (except in the gyrfalcons), and the lower part of the leg is covered with scales arranged like network. These birds are noted for their high courage, keen vision, and swift flight, which when in pursuit of prey has been estimated at 150 miles an hour; and many species have been partially domesticated for hunting other birds and ground game. The Peregrine Falcon, formerly common, but now rare, in Britain, is bluish-grey, narrowly barred with black above, and reddish-white with transverse black bars below. The length of an adult male is about 15 inches; the female is somewhat larger, and has a more decidedly rufous tinge on the under surface. It is the female that is the falcon of sportsmen; the male is a *tiercel*, and a bird caught wild in full plumage is a *haggard*. These birds prey on partridges, grouse, and plover, and sometimes on marine birds. Some authorities attribute the grouse disease to the destruction of falcons, which, it is said, by destroying sickly birds aided in the perpetuation of a vigorous race. There are closely allied forms in the southern hemisphere, chiefly distinguished by darker plumage. The gyrfalcons (that is, the falcons that fly in gyres or circles), have a more northerly range, and are sometimes made a distinct genus (*Hierofalco*). The Norway gyrfalcon (*F. gyrfalco*), a rare British visitant, the Greenland (*F. candicans*), almost pure white, the Iceland (*F. islandus*), and the North American gyrfalcon (*F. labradorus*) have their habitats pretty accurately defined by their popular names. The Merlin (*F. aesalon*) and the Hobby (*F. subbuteo*) are British species, somewhat resembling, but smaller than, the Peregrine Falcon. The Lanner (*F. lannarius*) and the Saker (*F. sacer*) are natives of South-Eastern Europe and the adjacent parts of Asia and of North Africa. [KESTREL.]

Falcon, a cape in Algeria, forming the W. limit of the Gulf of Oran.

Falconer, HUGH, was born at Forres in 1808, and, after taking the degree of M.D. at Edinburgh, entered the service of the East India Company. His botanical and geological investigations were highly valuable, but his chief claim to distinction is the introduction of the tea-plant into India. The British Museum had the benefit of his services for several years, and he died in London in 1865.

Falconer, WILLIAM, born at Edinburgh in 1732, of humble parents and brought up as a sailor, developed a taste for poetry, and in 1751 produced some verses on *The Death of the Prince of Wales*. About ten years later he brought out *The Shipwreck*, based on his personal experiences, and became famous. He now left the sea for a time, and lived in Scotland with his relative, Robertson, the historian, compiling a useful *Marine Dictionary*, and a political sketch entitled *The Demagogue*. He tuned his lyre also to the praise of the Duke of York, and was rewarded with the post of purser to the *Royal George*. In 1769 he sailed on board the *Aurora* for the East Indies, but the vessel was never heard of again.

Falconidæ, a universally distributed family of Birds of Prey (q.v.), with about 70 genera and more than 300 species, distinguished by having the head and neck feathered, the beak stout and strong, the nostrils separated by a bony partition, the eyes deep set, with the upper margin of the socket projecting so as to form a kind of eyebrow, and the feet furnished with sole-pads, and strong sharp claws admirably fitted to hold and rend their prey. [BUZZARD, CARACARA, EAGLE, ERNE, FALCON, HARRIER, HAWK, KITE, etc.]

Falconry, the taking of game by trained hawks, has been practised from very early times in China and India. Layard found it figured in the sculptured ruins of Khorsabad, and it is depicted on some Egyptian monuments. Allusions to it are found in some Roman poets, and it was a favourite sport in the Middle Ages. King Alfred is said to have written a book on it. Harold appears in the Bayeux tapestry carrying a hawk on his fist. Laws of William the Conqueror rigidly regulated the keeping of hawks and falcons, the nobler kinds being reserved for the king and the great nobles. It was not till Magna Charta that the right was secured for every freeman "to have eyries of hawks and falcons in his own woods." Stringent laws, too, were enacted respecting the theft or unlawful possession of hawks. Shakespeare constantly alludes to the sport, which was affected by the fair sex (Mary Queen of Scots, for instance, when in captivity was entertained with hawking), and flourished until the 17th century, when Puritanism and the Civil Wars caused its decline in England, as the religious wars of Germany did in that country. At the Restoration it revived slightly, and has been practised in England by a few enthusiasts down to the present day. A revival in Holland about 1840 has contributed to its continuance with us. But the development of the gun and the enclosure of land have killed it, just as they have favoured battue shooting and decreased the

importance of trained sporting dogs. Open country is requisite for the sport, as the falconers have often to gallop some distance after the hawk. In kite-hawking runs of five or six miles were not unknown. Though when the "fowling-piece" was little developed more game could be taken by hawking than in other ways, rooks, larks, ravens, kites, and magpies were also pursued, as being high flyers and strong on the wing. Heron hawking was a favourite sport. Pheasant hawking was sometimes pursued with dogs, which found the hawk when she had dropped on her prey. Hares, rabbits, and grouse were (and are) hawked. Female hawks and falcons are preferred, being larger and more powerful than male. Falconers divide them (a) into long-winged (falcons) and short-winged (including the goshawk, merlin, and sparrowhawk), and (b) into haggards or passage-hawks (wild birds caught and trained) and eyases (birds brought up from the nest). Haggards are trained by being kept continuously hooded for a time, meanwhile being accustomed to be carried on the fist, and to the voice. They are then at first fed with a "lure" (a dead bird, or an imitation of one baited with meat). Eyases, after being accustomed to the bell and strap (see below) are allowed to prey for themselves for a short time, but will come back to be fed and so are recaptured. In flying the birds they are taken out on the fist, hooded and wearing two short leather straps (*jeunes*), one of which is permanently attached to each leg. A lensh is run through these, and a light bell also attached to the leg. When game is started the bird is released, unhooded, and "flown at" it. Sometimes this is done before the game is found, when the bird will "wait on" above the party till the prey is started. The hawk then rises, usually at last flying round and round the prey (or "quarry") in large and gradually ascending spirals, and finally swooping down on it. Meanwhile the falconers ride after her, tempt her away with a lure, and hood her again. Great pains are taken in the training to teach the hawk not to carry her game. Falcons are, of course, the most esteemed of the birds used; they have occasionally been obtained from Norway and Greenland. The peregrine falcon is the most usual. Goshawks have now and then been used. The merlin is flown at larks, the tiercel or male peregrine at partridges, pigeons, and magpies. The sport has a most elaborate vocabulary.

Falemé, a tributary of the Senegal river in Senegambia, W. Africa. Rising in the borders of the Mandingo country, it flows N.W. for about 200 miles, and joins the Senegal near Bakel.

Falernian Wine, celebrated by Horace, was grown on the Massic Hills in Campania. In Pliny's time its quality was declining. A modern Italian brand has appropriated the name.

Fali, a negroid people of Adamawa, Central Soudan, between the upper course of the Benue river and the southern frontiers of Baghirmi. Next to the Battas, the Fali are the most numerous nation in Adamawa, comprising as many as fourteen distinct branches. Their speech differs fundamentally from all the surrounding languages, and the Fali

are also distinguished by a relatively fair complexion, in this respect resembling the Füláh intruders more than the negro aborigines of Adamawa. Some are found mixed with Beles, and others in the province of Kalam, on the Bornu frontier. (Barth, *Travels*, vol. ii.)

Faliero, ORDELAFO, Doge of Venice in 1102 in which year he took a fleet to aid Baldwin, King of Jerusalem, against the Saracens. He added Dalmatia, Croatia, and other territories to the possessions of the Republic, and was killed at the siege of Zara in 1117.

Faliero, or FALIERI, MARINO, a Venetian of illustrious family, who in 1354, after many services to the state, was elected Doge at an advanced age. He entered into a conspiracy to massacre the senators and nobles, but his design being detected, he was beheaded (1355), and, instead of his portrait in the long line of chief magistrates preserved in the palace, there is a picture of the throne covered with a pall. Byron, who has made his fate the theme of a drama, attributes his treason to anger provoked by insults to his young wife.

Falk, DR. PAUL LUDWIG ADALBERT, the son of a Lutheran pastor, at Mettschan, Silesia, was born in 1827. He graduated at the university of Breslau, embraced the profession of the law, and was gradually promoted from one judicial post to another until in 1868 he was appointed councillor to the Ministry of Justice in Berlin. Having previously sat in the Prussian House of Deputies and the North German Reichstag, he became a member of the first Imperial Parliament, and was chosen by Bismarck in 1872 as Minister of Public Worship. His policy aimed at diminishing the power of the Romish Church in North Germany, and with that end in view he framed a series of repressive enactments known as the Falk Laws. These measures brought upon him great unpopularity, and he resigned in 1879.

Falkirk, a parliamentary borough of Stirlingshire, is situated on a slope overlooking the Carse of Falkirk, and near the canal that connects the Forth with the Clyde. It is connected by railway with Edinburgh and Glasgow, from each of which it is little more than 20 miles distant. The church, rebuilt in 1810, contains some ancient monuments, and the town possesses the usual public buildings. There are no important manufactures, but the market is well supplied, and the three cattle fairs or "trysts" rank among the chief in Scotland. The Carron and other iron-works are in the neighbourhood. In conjunction with Lanark, Hamilton, Airdrie, and Linlithgow, Falkirk sends one member to Parliament. Two great battles have been fought here. In 1298 Edward I. defeated Wallace, and in 1746 the Young Pretender routed the forces of the Crown. Population (1901), 29,714.

Falkland, LUCIUS CARY, VISCOUNT, was born at Burford, Oxfordshire, in 1610. At Trinity College, Dublin, and at Cambridge he laid the foundations of a scholarly education, and was distinguished for his knowledge of Greek. Succeeding to his father in 1633, he held an appointment in the Royal

Household, but abandoned it to join as a volunteer in the expedition of 1639 against the Scots. In 1640 he entered Parliament, supported the prosecution of Strafford, and displayed strong sympathy with the popular cause. However, on the outbreak of Civil War he preserved his allegiance to the king, and became Secretary of State, though he felt deeply the wrongs of the Commons, and abhorred the double-dealing of his royal master. His courage in the fight at Edgehill was as conspicuous as his humanity after the battle was over. At Newbury he joined Lord Byron's cavalry as a volunteer, and was shot in the front rank (1643). Clarendon uses the highest language of commendation in describing his character, and all his contemporaries regarded him as the most virtuous and enlightened man of his age. He wrote a *Discourse on the Infallibility of the Church of Rome*, and is believed to have helped Chillingworth in his *History of Protestantism*.

Falkland Islands, THE (Fr. *Les Îles Malouines*), a group of some two hundred islets off the E. coast of South America (lat. 51° to 52° 30' S., long. 57° 40' to 61° 20' W.). They were discovered by Davis in 1592, colonised by France in 1763, taken by Spain in 1767, and ceded to England in 1771, but not permanently occupied until 1833. Of the total area of 6,500 square miles, East Falkland and West Falkland make up five-sixths. The population, amounting to about 2,000, is principally engaged in sheep-farming, and frozen meat is exported in considerable quantities. Stanley Harbour on East Falkland is the chief town, and the residence of the governor. The climate, though wet and windy, is not unhealthy. The uninhabited group of South Georgia is attached to the Falklands. The coasts are much indented, and the climate cold, damp, rainy, and foggy. Wheat will not ripen, and there are no trees—the “vatchinal,” a woolly ragwort (*Senecio candicans*), 3 to 4 feet high, being the tallest plant. Most of the interior is covered by a thick peat formed of the stems of the “diddle-dee” or crowberry (*Empetrum rubrum*), the “Malvina tea” (*Myrtus nummularia*), a marsh-marigold, and sedges. On the bog are the round lumps of the “balsam-bog” (*Bolax glebaria*), a very slow-growing and condensed umbelliferous plant, which exudes a resin. The plants are from 3 to 8 feet in diameter. On the sandy shores grows that sweet and valuable fodder plant the “tussock-grass” (*Dactylis cæspitosa*), which has been introduced into the Hebrides, these islands in many respects resembling the Falklands. A wild fox is now extinct, and seals and whales have almost disappeared from the coasts. Penguins, wild geese, and other sea-birds are numerous. Mount Adam, the highest peak, is 2,315 feet. The rocks are sandstones, clay-slates, and quartzites, the latter forming conspicuous projecting white dykes and breaking up into the remarkable “stone-runs” which occupy many of the valleys. Most of the islands, the sheep, and the trade, are in the hands of the Falkland Islands Company.

Fallacy, unsound argument, or mode of arguing, leading to a specious but erroneous conclusion.

The ingenious puzzles of the later Greek sophists, and the more serious arguments, seemingly unassailable yet leading to a palpably false conclusion, of the Eleatic and Megarian schools in Greece, were of great use in stimulating logical theory. Many of these were dealt with by Aristotle in the earliest treatise on fallacies, the *Sophistici Elenchi*. Later logicians classified fallacies as formal and material. In the former the fault is in the reasoning; in the latter it is in the premises, and they are therefore outside the scope of logic proper. A number of formal fallacies are enumerated in the ordinary text-books of logic. Bacon's enumeration of *idola*, or phantoms, which prevent the reception of scientific truth (individual and racial prejudices; prejudices due to language, and false philosophical theories), is in some degree a classification of fallacies. J. S. Mill classed fallacies under five heads: (1) Simple Inspection; (2) Observation; (3) Generalisation; (4) Ratiocination; (5) Confusion.

Fallopins, or FALLOPPIO, GABRIELLO, was born at Modena about 1523. In 1550 he succeeded Vesalius as anatomical professor at Padua, and died there in 1562. In his short career he contributed much towards creating the rational science of anatomy, and his name is associated with the discovery of the “Fallopian” tubes, and with the investigation of the structure of the ear.

Falloux, FRÉDÉRIC ALFRED PIERRE, COMTE DE, was born at Angers in 1811. He devoted himself to politics, espousing with warmth the cause of the Bourbons and the *ancien régime*. After expressing his views in a couple of historical works on Louis XVI. and Pius V., he obtained admission to the Chamber of Deputies, where he allied himself with Montalembert and Berryer, taking a special interest in educational questions. In 1848 he opposed the Revolution, and supported the occupation of Rome. Louis Napoleon, as President, gave him the portfolio of Public Instruction, but after the *coup d'état* he retired into private life, dying at his country-house near Angers in 1886. He was elected to the French Academy, and wrote in his later years one or two devotional works and a history of *La Convention du 15 Septembre*.

Fallow, a portion of land left for a time without a crop to get rid of weeds, to render the soil more friable by exposing it to frost and drought, and to enable a fresh supply of soluble mineral substances, which may have been exhausted by previous crops, to be formed. This last object will be accomplished by water drawn up from below by capillary action; by substances brought down in small supplies by rain; by dust; by the action of earthworms; by atmospheric oxidation and hydration, and other spontaneous decompositions of previously insoluble mineral substances in the soil; and by nitrification (q.v.). Fallowing may be looked upon simply as a prolonged process of tillage. It differs in duration, “green crop fallow” extending from harvest to the time for sowing turnips and analogous crops in the following spring, and “summer,” or “naked, fallow” continuing through the summer until the time for

sowing autumn-sown wheat. Green crop fallowing begins with paring the stubble-fields directly they are reaped, and harrowing off the weeds, or using a "grubber," and leaving the weeds to be killed on the surface by winter frosts. Manuring is then carried out at once, and in the following spring the soil may be freed from weeds and loosened to the depth of 6 or 8 inches necessary for drilling green crops by the use of light grubbers. The longer "naked" fallow is now only used on very stiff clay soils. It consists in deep ploughing in autumn; a second ploughing and two cross-ploughings in spring; stirring by the grubber and harrow, so as to expose the weeds to drought, as often as possible in the summer; manuring in July; and adding lime, if necessary, before the final ploughing or "seed-furrow."

Fallow Deer (*Dama vulgaris*), a partially domesticated deer kept in parks in Britain. Its home appears to be the south of Europe and the north of Africa; but there is no exact knowledge as to how it was introduced into the north of Europe. When adult it stands about 3 feet high at the shoulder; the summer coat in both sexes is yellowish-brown spotted all over white, and in the winter the colouring becomes more sombre. The darker variety is said to have been introduced from Norway by James I. The venison is much esteemed. Only the buck has antlers; these appear in the second year, increasing in development till the sixth, when the animal is a "complete buck." They then have two tines, and are palmated in the upper parts, the expanded portions giving off snags on the posterior surface. In the Persian Fallow Deer (*D. mesopotamica*) the palmation is at the base instead of at the extremity.

Fall River, THE. [VAAL RIVER.]

Falmouth, a parliamentary and municipal borough and seaport in Cornwall, on a branch of the estuary of the river Fal, 79 miles S.W. of Exeter and 14 miles N.N.E. of the Lizard Point. It has an excellent harbour, 5 miles long by a mile broad, with numerous creeks. Hence it used by vessels of the royal navy and by several lines of steamers, being the most westerly port in the Channel. Pendennis Castle commands the entrance, and is faced by St. Mawes Castle on the opposite bank. The coasting trade is considerable, and the pilchard fishery employs many of the population. Nothing is known of the town before the middle of the 17th century. With Penryn it returns one member to Parliament. Pop. (1901), 11,778.

False-bedding, also known as *current-bedding* or *oblique lamination*, is the inclination of shallow water deposits, whether marine or estuarine, at various and high angles even in a very small space, instead of their lying horizontally. It is the result of conflicting currents heaping the material up in various directions, and a similar appearance is produced in railway embankments, rubbish-heaps, etc., by the tilting of various material from different directions. It is a common indication to the geologist of shallow water conditions, as in the variegated sands of the Trias in Cheshire, the flags

of the Forest Marble, the silver sands of the Folkestone Series in the Lower Greensand of Kent and Surrey, and the gravels of the Lower Thames valley.

Famagosta (ancient *Arsinoe*), a seaport and capital of a district on the E. coast of Cyprus. In the palmy days of Venice the port did a great trade with the East, but it is now a wretched and half-ruined settlement, accessible only to vessels of light burden. Some improvement has taken place under British rule. In the vicinity are the remains of Salamis and Constantia, marking the site of the ancient city.

Familiar, FAMILIAR SPIRIT, the supernatural attendant and servant of a magician, or witch, generally assuming the form of one of the lower animals. This meaning seems to have arisen from the particular sense of the Latin *famulus* = a servant of the gods (*Ovid: Metam.*, viii. 272). The "familiar spirit" of the Authorised Version appears to have been an indwelling and controlling influence rather than an entity external to the witch or diviner; and this difference will be clearly brought out if one compares the passages in which this expression occurs with the corresponding ones in the Vulgate. In the Middle Ages the notion of familiar spirits was widely diffused, and during the witch mania any old woman who kept a pet cat or dog was almost sure to be denounced as a witch. In the Faust folk-legend and in Marlowe's version Mephistopheles is a true familiar spirit; in Goethe's poem he is THE Devil, *der Junker Satan*, as he is called by the old witch who brewed the broth that made Faust young again. [FAUST.]

Family. 1. A word of Italic origin, which came into English, through the French, from the Latin, in which tongue it signified (1) The whole number of slaves belonging to one master; then (2) A house and all belonging to it, a household; and (3) One of the units of which a *gens* was composed—i.e. a group of persons tracing their descent through the male line back to a common ancestor. [AGNATES.] Andrew Lang defines the family as "the small community formed by the union of one man with one woman, and by the increase of children born to them." When this union has moral and legal sanction it gives us the family of modern times and the unit of civilised society, though the term is often extended so as to include relatives of both parents.

If families had been formed on one uniform plan at all times, and all the world over, nothing would be easier than to construct a workable hypothesis of how aggregations of families formed groups or tribes, and how these tribes gradually coalesced with others, to form a nation. So far, however, from this having been the case, the family has not only been a most inconstant quantity in the past, but is actually so—though, of course, in a less degree—in the present. The family of the people of London, or Paris, or Vienna, where the children belong to the father is not the same as the family of the Cingalese, where the father has no claim to his offspring, who belong to their mother; and the Cingalese family differs again from that of the

Todas of southern India, where "the marriage system is elastic, and when women are scarce several men have to be content with one wife between them; but as women become more numerous, a greater proportion of men are able to procure a wife apiece."

It was till quite recently assumed that the primitive family consisted of the man, as head, with his wife or wives, children, and servants, or slaves, over all whom he exercised unlimited control, necessary in early times, but since limited by law and custom. As the Roman *familia* in course of time grew into a *gens*, and as the Twelve Tribes were said to be the descendants of the sons or grandsons of Jacob, it was reasoned that tribes and nations everywhere originated in a similar way. But kinship in the Roman family was reckoned on the father's side only; in many cases in the book of Genesis it seems to be reckoned on the mother's side. Professor W. Robertson Smith (*Kinship and Marriage in Arabia*, ch. vi.) says that "Eve is the personification of the bond of kinship (conceived as exclusively mother-kinship) just as Adam is simply man, i.e. the personification of mankind." And speaking of the account of the institution of marriage (Gen. ii. 24), he remarks: "It reminds one of the well-established custom of marriage in Ceylon, where the woman remained with her kin, and chose and dismissed her partner at will, the children belonging to her kin, and growing up under her protection." This form of union McLennan calls *beena* marriage from its native name; and there are many examples of it in the first book of the Hebrew Scriptures. Lamech seems to have been the first polygamist (Gen. iv. 19), but his example was followed by the Patriarchs. But this polygamy would not of itself militate against agnatic kinship, for the chastity of married women was, in later times at least, rigidly guarded, and any breach of it strictly punished (Lev. xx. 10). Abraham did not dwell with his mother's kindred; but Sarai gives him Hagar the Egyptian, that she, the barren wife—not the husband—"may obtain children by her" (xvi. 13; cf. xxi. 10).

The marriage of Isaac was by purchase, and the dowry was given to the bride's brother and mother, not to her father (xxiv. 53). But marriage of the *beena* type seems to have been quite familiar both to Abraham and to the "eldest servant of his house," who was to seek out a wife for Isaac, for the servant puts the case to his master thus—"Peradventure the woman will not be willing to follow me unto this land: must I needs bring thy son again unto the land from whence thou camest?" [i.e. that he may be received into his wife's family] (xxiv. 5). In this marriage the wife's kindred asserted no claim to her children, for she was purchased (cf. xxiv. 12). But when Jacob carried off his wives, Leah and Rachel, and his children, Laban pursued him, and asserted his right to them, calling them "my sons and my daughters" (xxi. 28, 55). Another notable example of this type of marriage is that of Samson with the Philistine woman (Judges xiv.-xv. 2). And for direct evidence that kinship on the mother's side was reckoned as kinship by blood, see Gen. xxix. 14, 15; Judges ix. 1-4.

The custom of the Levirate (Deut. xxv. 5-10), by which the brother of a man dying without issue was bound (under penalty of being publicly dishonoured) to marry the widow, must have tended to complicate relationships among the Hebrews. This custom, however, was widely distributed, and still exists in many places among races of low culture, and this whether the surviving brother be already married or not (Lubbock: *Orig. Civil.*, ed. 1882, pp. 141, 142). The Levirate seems closely akin to the so-called Tibetan polyandry, where a group of brothers have one wife between them, and the children can trace their descent to a common grandfather, though not to a common father. Something similar seems to have prevailed among our own ancestors in Caesar's time (*De Bello Gal.* v. 15), though there husbands in succession seem to have joined the union, and all the children were reckoned to belong to him who first married the woman. But in the family of civilised life kinship is always reckoned on the father's side. How then did this originate? Polygamy (q.v.), if the chastity of the wives be ensured, might, and doubtless did, give it, to a certain extent. Polyandry except of the Tibetan type would not do so, so that where kinship is reckoned through the mother one may expect that polyandry has prevailed, probably from scarcity of women—in its turn generally due to infanticide (q.v.) and leading to marriage by capture. The upward struggle from either of these types to the modern monandrous family must have been long and arduous. With primitive man unions were probably temporary. According to Darwin he would either live with a single mate or be polygamous, and the most powerful males would secure, and be able to defend, the most attractive females. But as they would be governed more by their instincts than by their reason children would be numerous; and thus the struggle for existence would be rendered severe. And it is clear that it was not till man had attained a fairly high degree of culture that the monandrous family arose in the form we know it, in which the union is lifelong, and imposes far more important duties on the husband than the mere support of the wife and the procreation of children. [MARRIAGE.]

2. In *Zoology*, a group of genera agreeing in general characters. The names of families are obtained by adding *-idae* to the stem of the name of the type-genus. Thus from *Otaria* we get *Otariidae*, the family containing the eared seals; from *Felis* we get *Felidae* = the Cat family. [GENUS, PHYLUM SPECIES, TAXONOMY, ZOOLOGY.]

Famine (Latin *fames*, hunger) a scarcity of grain, or other staple food of a people, such as to produce general starvation. Its causes have been classed as natural and artificial. *Natural* are either drought, generally in tropical countries, or excessive rain in more northern climates; inundations; the inroads of destructive insects—e.g. locusts, and (much less frequently) storms, high tides, volcanic eruptions, and now and then pestilences. Destruction of forests is a frequent cause of drought, and sometimes of flood; since the rain then runs off more rapidly, denuding the slopes

of earth, and overlaying the natural drainage. Hence great attention is now paid to the conservation and replanting of trees, especially in India and on the Continent. [FORESTRY.] Flooded land becomes heavy and sodden, and apt (partly from the destruction of the earthworms) to cake and prevent air reaching the roots of the vegetation. Wet seasons too often promote mildew and various blights, as in the Irish potato famine. Artificial causes, which mostly however are only subsidiary to natural, are wars, restriction of the free passage of goods, and, according to Mr. Walford (*see* below) debasement of currency. An attempt has been made by Mr. J. N. Lockyer to connect the periodical failure of the rains in India with the eleven-year periods of the occurrence of sun-spots (q.v.), which are signs of internal solar activity; but the records available only extend over the last seventy years.

Until civilisation is tolerably advanced and variety of industry and facilities of communication are pretty thoroughly established, almost every community is within measurable distance of famine once a year. Spring is called by the Greek poet Alcæus, "the time when all is blooming, but there is not enough to eat." Again, between 1066 and 1600 about fifty famines are recorded in England alone—on the average, about one every nine years. Clearly, when a population chiefly produces food for its own consumption, has little stored wealth, or coined money, and poor communications, any failure of crops in a district must mean distress. This was one cause of the great Irish famine. Agriculture was the staple industry, and little coin was in circulation. Again: population tending to multiply up to its means of subsistence, a people that lives on the cheapest staple food available is always liable to famine should that fail. This was the case in the great Irish famine of 1845-47.

The means of coping with famine have been much discussed, especially with reference to India. Irrigation works are an obvious preventive, and many have been constructed; but it has been questioned if they can generally be commercially successful, and, if not, how can they be paid for by a people which has so little taxable surplus? Conservation of forests is a preventive more generally accepted. Improved communications—*e.g.* railways—are of use less as facilitating transport of grain in a famine (since the people have then nothing to buy it with) than in stimulating production in good years by opening up markets, and so enabling the cultivators to acquire and store wealth. Relief works are commonly opened in Indian famines, as during the Irish famine of 1845-47; but the labour of half-starved men is not of much use, and the works have necessarily been hurriedly and often unskillfully planned. Variety of industry, variety of crops, and free movement of goods are obvious preventives and palliatives. Still more efficient is a tolerably high standard of comfort, preventing increase of population up to the limit of subsistence. The most civilised part of the world, it may be said, is tolerably free, on the whole, from any danger of severe famine, until (according

to Malthus's theory) food production reaches its ultimate limits and population overtakes it. It has been estimated recently that the world will be pretty well filled by the end of the 20th century, but much industry has recently been expended by Prince Kropotkin and some American writers in showing that the limit of food-production is indefinitely remote.

Mr. Edward Walford in a remarkable paper (*Journal of the Statistical Society*, vols. xlii. xliii.) established inductively the connection between famines and the causes above mentioned, and gave a list of 350 recorded famines, of which the following may be cited:—

- A.D. 879.—Universal famine.
- 1058-1065.—Seven years' drought in Hindostan.
- 1069-1072.—Famine, after Norman Conquest, in England.
- 1065-1072.—Seven years' drought in Egypt, and pestilence.
- 1316-1317.—Great dearth in England (from wet seasons).
- 1347.—Italy (followed by pestilence—two-thirds of population destroyed).
- 1527.—Severe famine in England.
- 1769-70.—Terrible famine in India: a million people died.
- 1822.—Irish famine.
- 1846-47.—Irish famine: about 275,000 died of starvation; some estimates place the deaths from starvation and pestilence combined at over a million. These, with emigration, reduced the population by two millions.
- 1865.—Great famine in Orissa, India.
- 1877.—Southern India: very extensive.
- 1877-78.—Famine in North China due to floods in some districts, drought in others: between three and four million persons required relief.
- 1878.—Morocco.
- 1882.—Russia (due to drought from destruction of forests).
- 1894-7.—Great Famine in India extending over a large area, followed by pestilence.

Fan. 1. An instrument used to create a current of air. Hand fans are figured on Egyptian monuments dating as far back as the 17th century B.C., the kings being portrayed, at Thebes, for instance, as surrounded by fan-bearers. In Assyria, in China, in Persia, and in India, the use of the fan goes back to a remote antiquity. The materials were often feathers, or still oftener paper spread over a frame of stiffened wood or bamboo. In Greece fans date at least as far back as the 5th century B.C. Euripides in the *Helen* attributes their use to that queen and speaks of them as Phrygian. In Rome, too, they were much used. Both Greeks and Romans rarely fanned themselves; usually a female slave or eunuch was employed, but Ovid in the *Ars Amatoria* mentions fanning as one of the attentions paid to a lady by her admirers. Men, too, were (at Rome) often fanned by their slaves. In some Pagan religious ceremonies fans were carried, and in the early Western Church they were used to keep flies from the sacred elements. In the Eastern Church they are still used, and are (it is said) one of the insignia of the deacon. In Greece and Rome they were used as a bellows by cooks. All early fans, however, were non-folding. The folding fan is said to have originated in Japan, and to have been imitated in China. In the early Middle Ages Eastern fans were imported from the Levant by the Venetians. They were introduced into England during the reign of Richard II., and became fashionable in France through the example of Catherine de Medicis. Watteau, Laocret, and other distinguished painters

have frequently adorned fans with their paintings. Folding fans are largely manufactured in China, but commonly reserved for the European market. Paris and the neighbouring departments (especially the Seine-et-Oise, where wooden frames are made) are the chief European seat of the manufacture. Of late years the use of the fan in decoration, in imitation of Japanese art, has been very general in England. A wood or ivory frame, and a covering of decorated paper, silk, satin, or feathers, or combinations of these materials, make up the modern folding fan, which is both graceful in itself and lends itself to graceful uses. Thus, in the 18th century, there was a regular code of signals with the fan (described by Addison in the *Spectator*); for instance, the manner of holding it indicated the political creed of the holder, and it was a recognised instrument of flirtation. Possibly the use of the fan to cool the air [PUNKAH] was suggested by the winnowing fan, from which the various mechanical fans to create a draught or get rid of waste material are doubtless derived.

2. In *Engineering*, a special form of blowing machine for the purpose of creating a draught. The most generally adopted form is that known as the centrifugal fan, on the same principle as the centrifugal pump. A wheel with specially shaped vanes is made to rotate in a metal chamber. The air is drawn into the wheel and forced out in a definite direction by the rotating vanes. Such fans are much used for ventilation and for the production of forced draughts in furnaces.

Fandango, a lively Spanish dance in triple time, danced by a male and a female dancer beating castanets, to the accompaniment of the guitar. The man sometimes carries a tambourine.

Fans, a numerous and powerful people of West Central Africa, who since the middle of the 19th century have steadily advanced from the interior towards the coast, where they have been settled for some years in the Ogoway and Gaboon basins. The national name *Fan* (plural *Ba-Fan*) means "man," and occurs in several forms, such as *Faon*, *Fanne*, *Panne*, *Paouin*, *Pahouin*, this last being generally adopted by French writers. On the seaboard they form two great divisions, the *Maké-Fan* or *Osyeba*, south of the Ogoway, and the *Mbelé-Fan* or *Mpangwe*, north of the Ogoway, both subdivided into endless tribal groups, all speaking dialects of the same language, which seems to be remotely allied to the Bantu family, and all sharply distinguished in their physical appearance from the surrounding negro populations. The features are far more regular, the complexion much lighter, and often inclining to a yellowish hue, the hair less kinky, the beard fully developed, the figure tall, slim, shapely, and muscular. They have a sinister look, and seldom laugh; but are brave, intelligent, and even truthful and trustworthy. The Fan domain extends inland for an unknown distance, in the direction of the Niam-Niam people, whom they resemble in their pronounced cannibal tastes, in the manner of dressing the hair, in the use of bark coverings, vegetable dyes for painting the body, many-pointed iron darts, leopard skins worn by the

chiefs, and in many other respects. They are excessively fond of ornaments, intertwining the hair with feathers and beads, encircling neck and waist with strings of cowries and buttons, while many of the women are so overlaid with copper bangles, armlets, and anklets, as to make locomotion almost impossible. Nevertheless, they are the most vigorous and industrious of all the peoples on the seaboard, skilled forgers and armourers, potters, boat-builders, and husbandmen. In the regions known to the whites they number at least 200,000 souls, and here they are increasing rapidly, both by constant migrations from the interior and by the natural increase of births over deaths. Hence they are much feared by all the neighbouring peoples, whom they tend to crowd out or enslave, and whom they easily overmaster wherever they present themselves. (Capt. Burton, *Gorilla Land*, i.; Winwood Reade, *African Sketch Book*, i.; Oscar Lenz, *Skizzen aus W. Afrika*, Berlin, 1878; S. de Brazza, *Bull. de la Soc. de Géographie*, 1877.)

Fanshawe, SIR RICHARD, born in Hertfordshire in 1608, and educated at Cambridge, was employed by Charles I. as resident-minister at Madrid. In 1641 he returned to take up arms for the king, but, being made prisoner at the battle of Worcester, remained for several years in captivity. After the Restoration he was sent first to Ireland, then to Portugal, where he negotiated the king's marriage, and lastly to Spain, in which country he died in 1666. Among other literary performances he translated Guarini's *Pastor Fido* and the *Lusid* of Camoëns into English verse.

Fanti, a negro people of the Gold Coast, who belong to the same stock as the Ashanti, and speak the Akân, a dialect of the same Tshi language. But from remote times the Fanti have been the deadly enemies of the Ashanti, and have always allied themselves with the English in their wars against that nation. Their chief town is Abra, twelve miles from the coast, and the English stations of Elmina, Cape Coast Castle, Anambu, and Winebah are all in Fanti territory, which is now comprised in the British protectorate. Those of the seaboard are chiefly occupied with fishing and navigation, while the more inland tribes are traders, hunters, and agriculturists. Like all Tshi-speaking peoples, the Fanti are of the true negro type, as distinguished from the negroids of the Mohammedan states to the north, and the Bantu populations of the Congo regions to the south. In the 17th century they extended from the Iron Hills to Salt Pond, and at that time their territory comprised the states of Commani, Fetu, Sabu, and Fantyn (Fanti), all of which have disappeared except the last. (Brackenbury and Huyshe, *Fanti and Ashanti*, 1873; Major A. B. Ellis, *The Tshi-speaking Peoples of the Gold Coast*, 1887.)

Fan Tracery, in *Architecture*, a kind of vaulting in which all the ribs that rise from the spring of the vault have the same curve and extend equally in every direction, the interstices being filled with lace-like ornament, so that the effect is like that of a fan. It is a peculiarly English kind of work: Henry VII.'s chapel at Westminster, King's

College, Cambridge, and St. George's Chapel, Windsor. It is peculiar to the late Perpendicular style.



FAN-TRACERY (ST. GEORGE'S CHAPEL, WINDSOR).

Farad, in *Electricity*, is the unit of electrical capacity. A condenser (q.v.) has that capacity when a charge of one coulomb of electricity brings it to a potential of one volt. Such a capacity is enormous, and a much smaller practical unit is therefore desirable. On this account the *microfarad* is used; it is the millionth part of a farad. [ELECTRICITY.]

Faraday, MICHAEL, F.R.S., the son of a Yorkshire blacksmith, was born at Newington, Surrey, in 1791. His early education was of the slightest, and he was a bookbinder's apprentice at the age of 20, when by chance he attended a course of Sir Humphry Davy's lectures at the Royal Institution. He took notes of what he heard and sent them to Davy, who at once engaged him as assistant. However, a kind of jealousy appears to have prevented the master from cordially helping on his able young *protégé*, and it was owing to his own exertions that Faraday in 1825 was made director of the laboratory, and in 1827 Fullerian Professor at the Institution, with which he was connected for more than half a century. As a chemist he is credited with many important discoveries, all of a more or less practical nature, such as the alloys of steel, the composition of glass for optical purposes, the compounds of chlorine and hydrogen with carbon, and of sulphuric acid with naphthaline. From 1830 he concentrated his energies chiefly on magnetic and electrical phenomena, and his discovery that an electrical current is producible from the revolution of a magnet has been fraught with marvellous influence on material progress. His researches covered the whole field of electro-magnetism, and were full of suggestions worked out by later inquirers, the general tendency of his speculations pointing to the now established doctrine of the correlation of the physical forces. Faraday excelled also in the art of popularising science by the use of simple and clear language illustrated by striking experiments. Much of his

work is recorded in the *Philosophical Transactions* and in scientific journals, but he produced three important treatises—viz. *Experimental Researches in Electricity*, *Fundamental Researches in Chemistry and Physics*, and *On the Various Forces in Nature*. In his private life he was singularly modest and happy. He scorned money-making, and was content with his small salary, to which a Civil List pension of £300 was added in 1835. A grant of rooms in Hampton Court Palace provided him with a home in his old age. Though married, he had no children. His religious views were somewhat eccentric, for he attached himself to the small sect of Sandemanians, to whom he preached every Sunday. Honours of all kinds were bestowed upon him by learned bodies at home and abroad, but he rather avoided than sought any personal distinction. Working up to the last, he died in 1867.

Farce (said to be from Latin *farcio*, to stuff), a short comic dramatic sketch, full of broadly ludicrous incident but without any very elaborate plot. The Italian mimes [COMEDY] are perhaps the earliest kind; but the farce proper first appears in mediæval French literature of the 14th and 15th centuries, probably as the direct successor of the fabliaux (q.v.). These farces are satires on various commonplace aspects of bourgeois life. Some were partly the basis of Molière's comedies. During the last two centuries farce has been a feature of the English stage: but tends now to be superseded by musical sketches after the type of the French vaudeville.

Farcy. The nodules which appear beneath the skin as the result of the invasion of the subcutaneous tissue by the bacillus of glanders are termed *farcy buds*. [GLANDERS.]

Farel, GUILLAUME, was born at Gap in France in 1489. He studied in Paris under Lefèvre d'Étaples, became a Protestant pastor, and after a long course of preaching in Dauphiné and Switzerland, settled at Geneva. He influenced Calvin to join him there, and assisted the great reformer in drawing up the Confession of Faith and disciplinary rules (1537). The next year they both were driven from their posts, and Farel took up his abode at Neuchâtel, where he died in 1565.

Faria y Sousa, MANUEL DE, born probably at Souto, Portugal, in 1590, and, early attached to the service of the Spanish Court, became secretary of the embassy at Rome in 1631, but retired at the end of three years to devote himself to literary labours in Madrid. His *History of Portugal* is a valuable work, and is supplemented by three other well-known compilations—*El Asia Portuguesa*, *La Europa Portuguesa*, and *El Africa Portuguesa*. He also produced a lengthy commentary on the *Lusiad*, and a volume of stilted poems entitled *Puente de Aganippe*. He died in 1649.

Farini, CARLO LUIGI, was born at Russi in the Roman States in 1822, and educated at Bologna for the medical profession, in which he achieved some distinction. A moderate Radical, he was driven into exile in 1842, spending several years in France and England. In 1848 he came back, and

was returned as deputy for Faenza, acting first as Minister of Health and afterwards as Minister of the Interior in Piedmont. He vigorously seconded the policy of Cavour, and in 1859, being chosen Dictator at Modena, brought that state and Parma into union with Sardinia. In 1860 Cavour gave him the portfolio of Commerce, and in 1862-63 he was for a short time Premier, resigning through ill-health. He died in 1866. Mr. Gladstone, his personal friend, translated into English his chief work, *Il Stato Romano*.

Farm (A.-S. *feorm*, provisions, food), originally land let on hire for a rent in kind, which (in England during the 13th century in particular) gradually became commuted for a money payment. The term was extended to all kinds of letting, especially that of the right of collecting taxes. [FARMERS-GENERAL.] It is sometimes, though probably erroneously, derived from the Low Latin *firma*, an agreement, which probably is itself derived from *feorm*. The peculiar history of land tenure in England has made "farmer" synonymous with capitalist-cultivator, so that in America it is applied to owners who cultivate their land.

Farmer, HUGH, born at Shrewsbury in 1714, attained eminence as a Nonconformist divine, and preached for many years at Salters' Hall, holding a pastorate office at Walthamstow. He wrote several curious treatises on *The Nature of Christ's Temptation*, *On Miracles*, and *On the Demoniacs of the New Testament*, provoking much controversy by adopting a somewhat Rationalistic tone. Retiring from the ministry about 1780, he died in 1787.

Farmer, RICHARD, born at Leicester in 1735, and educated at Cambridge, took holy orders, though his tastes were rather social and literary. In 1766 he produced his *Essay on the Learning of Shakespeare*, in which he displayed a great knowledge of Elizabethan literature, and demolished the theories of such worshippers of the bard as desired to attribute to him sound classical scholarship. He became master of his college (Emmanuel), Vice-Chancellor, and Prebendary successively of Lichfield, Canterbury, and St. Paul's, rendering himself famous in the latter capacity by introducing sculpture into the cathedral. With much good sense he twice declined a bishopric, and died at Cambridge in 1797.

Farmers-General, in France, before the Revolution, were large capitalists usually associated in firms or companies, who collected certain taxes, especially customs duties, the gabelle or salt tax, and the tax on tobacco, guaranteeing and often advancing a sum in return to the Treasury. Great abuses were naturally connected with this method of collection, which was abolished at the Revolution, and many of the profession were beheaded during the Reign of Terror.

Farming. [AGRICULTURE.]

Farne or Fern Islands, THE, also called the STAPLES, are 17 in number, and lie off Bamborough Head on the coast of Northumberland, from which they are $1\frac{1}{2}$ miles distant. On the largest of the

group are two lighthouses. The wreck of the *Forfarshire*, in which Grace Darling (q.v.) immortalised herself, took place here in 1838. The remains of St. Cuthbert's Priory can still be traced on one of the rocks.

Farnese, the surname of an eminent Italian family, which rose into greatness from Farneto, near Orvieto, in the 13th century, and supplied one Pope to Rome and many princes and generals to minor states, besides encouraging the arts by lavish munificence. The Farnese Palace contains some of the finest works of antiquity, including the Farnese Hercules and the Farnese bull.

Farnese, ALESSANDRO, was born at Carino, Italy, in 1468, and was elected to the Papal chair in 1534 as successor to Clement VII., under the title of Paul III. His tenure of office was marked by many important events. It was he who hurled a bull of excommunication against Henry VIII., and formulated another famous decree known as *In Censu Domini*. He leagued himself with Charles V. and the Venetians against the Turks, brought about peace between France and Italy, aided to establish the Order of the Jesuits (1540), and convoked the Council of Trent (1542). A great patron of art, he summoned Michael Angelo to complete the construction of St. Peter's. His affection for his son, Pietro Luigi, a dissolute voluptuary, whom he made Duke of Parma, brought him into unpopularity, and provoked the hatred of Charles V. He died in 1549.

Farnese, ALESSANDRO, great-grandson of the above, and third Duke of Parma, was born in 1546, succeeded his father Ottavio in 1586. He had already distinguished himself as a soldier at the battle of Lepanto (1571), and had been entrusted by Philip II. with the government of the Netherlands. In 1590 he was sent to raise the siege of Paris, and defeated Henry IV., whom he again worsted two years later before Rouen. At Caudebec, however, he was mortally wounded, and died at Arras in 1592, never having taken possession of his principality.

Farnworth, a township of Lancashire, on the Lancashire and Yorkshire Railway, 3 miles S.E. of Bolton. The chief manufactures are paper, cotton, iron, and bricks. The town has a public park of 11 acres. Pop. (1901), 25,927.

Farøe or Farøer Islands, a group of 22 members in the Northern Ocean between Iceland and Shetland (lat. $61^{\circ} 25'$ to $62^{\circ} 25'$ N., long. 6° to 8° W.). They belong to Denmark, and have an area of 500 square miles, 17 of the number being inhabited. Though rising steeply to a height of two or three thousand feet, they are tolerably fertile, producing heavy crops of barley, turnips, and potatoes, and affording pasturage to thousands of sheep, but there is no timber. Immense flocks of sea-birds furnish feathers and eider-down for exportation, and fish is abundant on the coast. The chief of the group is Stromøe, on which is situated the capital, Thorshaven, the residence of the amtmann or governor. Coal, opals, and other valuable

minerals are found, especially in Süderöe. The Danes and other Scandinavian navigators draw their meridian through this spot. England occupied the islands from 1807 until the peace of 1814. The present inhabitants of the archipelago are almost exclusively of Norwegian origin, and the *Färiska*, or current speech, is a Norse dialect, while the official language is Danish. The natives are mostly descended from fugitives and sea-rovers, who arrived in the 9th century, and, like them, are still distinguished by their tall, muscular frames, physical strength, and longevity. Notwithstanding a severe and even stern outward expression, in harmony with their rugged environment, they are extremely kind-hearted and hospitable. They are occupied chiefly with fishing and pasturage, and the fine fleece of their flocks yields the raw material for a lucrative home industry.

Farquhar, GEORGE, born at Londonderry in 1678, and educated at Trinity College, Dublin, took to the stage very early, but abandoned it, owing to an accident by which he inflicted a mortal wound on a brother actor. Coming to London, he got a commission in Lord Orrery's regiment, but combined with soldiering the composition of sprightly, though licentious, comedies. His first piece, *Love in a Bottle*, appeared in 1698, and was followed by *The Constant Couple*, *Sir Harry Wildair*, *The Stage Coach*, *The Inconstant*, *The Recruiting Officer*, and *The Beaux' Stratagem*. The last, though written at a period of mortal sickness, is undoubtedly his masterpiece, and has kept the stage until the present day. He had a remarkable talent for the drama, and his plays are full of vivacity and light humour. Unhappily, just as he was on the verge of success, his health broke down mainly through struggles against poverty and the growing cares of a family. He died in 1707, leaving two daughters whom he commended in a touching letter to his friend, Wilks.

Farragut, DAVID GLASGOW, an American of Spanish blood, was born at Knoxville, Tennessee, in 1801, and, entering the United States navy, rose to the rank of captain in 1855. When the Civil War broke out he declared for the North, and received command of the naval expedition against New Orleans in 1863. He forced his way past the batteries that guarded the mouth of the river, destroyed the Confederate fleet, and captured the city. Operating from this base, he succeeded in the course of a few months in making himself master of the whole of the Mississippi. In 1864 he defeated the Confederates again in Mobile Bay, silenced the forts, and put an end to blockade-running. For these services he received the rank of admiral, hitherto unknown in the United States, and his statue was set up at Washington and New York. He died in 1870.

Farrar, THE VERY REV. FREDERIC WILLIAM, D.D., F.R.S., Dean of Canterbury, was born at Bombay in 1831. He received his early education at King William's College, Isle of Man, and King's College, London, passing thence to Trinity College, Cambridge, as a graduate and scholar of the

University of London. After a distinguished academical career he was ordained in 1864, and became a master at Harrow under Dr. Vaughan and Dr. Butler. In 1871 he was elected head-master of Marlborough College, and held that post with credit till his appointment as Canon of Westminster and Rector of St. Margaret's in 1876. He was made Archdeacon in 1883, Chaplain to the House of Commons in 1890, and Dean of Canterbury in 1895. As a Churchman his sympathies were broad, with a tinge of evangelical feeling, but he neither founded nor attached himself to any school, and his great work was to popularise theology and religious history. He first essayed literature as a writer of stories of public school life, and produced *Eric*, *Juhan Home*, and *St. Winifred's*. The science of language for a time occupied his attention, and several philological works followed on his romances. In 1874 appeared his *Life of Christ*, by far his most striking achievement, and this was succeeded by *The Life and Work of St. Paul* in 1879, and *The Early Days of Christianity* in 1882. His *Eternal Hope* (1877), in which he argued against the existence of Eternal Punishment, caused a considerable sensation. As a preacher also, his reputation stood deservedly high. He died in 1903.

Farrier (Fr. *ferrier*, from Latin *ferrum*, iron), a shoer of horses, who, before the development of veterinary surgery, was often also a horse doctor.

Fars, or FARSISTAN, a province of Persia extending over some 55,000 square miles, on the E. coast of the Persian Gulf, whence it stretches up to an elevation of nearly 3,000 feet, embracing part also of the sandy plateau beyond with the saline lake of Bakhtegan. The valleys of the intermediate region are picturesque and fertile, producing tobacco, wine, rice, dates, cotton, cochineal, and roses for the manufacture of ottar. Borax and naphtha are found in the plains, and the hills contain iron and lead, marble and alabaster. The rivers Nabon and Tab (ancient Arosis) flow into the Persian Gulf, and the Bundemeer (ancient Araxis) feeds the lake of Bakhtegan. Shiraz, Darab, Babahan, and Bushire are the chief towns. Near the former stand the ruins of Persepolis and its sculptured rocks, and the remains of Shalpur lie to the north-west.

Farthing (A.S. *feordh*, fourth), the fourth part of a penny, the smallest English coin; also the name of the fourth part of a noble (q.v.).

Faruckabad, a district and city in the Doab, N.W. Provinces, British India. The former has an area of 1,909 square miles; of which only a small portion lies outside the Doab. The soil is rich, and produces cotton, indigo, tobacco, etc. The city is well-built and salubrious, standing on the right bank of the Ganges, and connected by rail with Calcutta and Delhi. Its name signifies "City of Happiness," and is not wholly undeserved, though the prosperity of the place as a commercial centre has not increased of late years. Holkar was defeated here in 1805 by the British under Lord Lake.

Fasces, in ancient Rome, were twigs of birch or elm bound together in a bundle, and containing an axe, the head of which projected from them. They were carried by lictors (q.v.) before the consuls, prætors, dictator, and master of the horse, and in the provinces before the quæstors. When a general had been "saluted as imperator" by his soldiers in consequence of a victory, his fasces were wreathed with laurel. Probably they were of Etruscan origin, and they were carried before the Roman kings.



FASCES.

Fascination, the paralyzing influence said to be exerted by some serpents over their prey. The evidence in support of this influence is very slight; if it does exist, it probably arises

from inherited fear on the part of the victims. The behaviour of snakes in captivity towards their prey lends no support to the theory of fascination. Dr. Martin Duncan says, "The affection of birds for their young which causes them to flit about the nest and be destroyed with their little ones is usually but erroneously taken for fascination on the part of the snake. In fact, an analysis of any given instance of fascination shows it to be supposititious."

Fashoda, a village on the Nile, about 400 miles S. of Omdurman. Here Major Marchand was discovered by the Sirdar, Kitchener, after the victory of Omdurman (Sept., 1898). The Sirdar invited him to retire, but the Major refused to do so without orders from the French Government. Much excitement was aroused, rumours of war between the two countries being frequent; but in November, 1898, the French decided that Marchand must withdraw in deference to the attitude of England.

Fasti, in ancient Rome, strictly the "lawful days" (*fas*, divine law) on which legal or other business might be done. The succession of these days was long the secret of certain orders of priests, those for the current month *only* being announced each month by the pontifices. Eventually, however, one Caius Flavius, a scribe of Appius Claudius Cæcus, got hold of the sacred books and published the list. Hence lists of such days were called *fasti*, and were naturally extended to include anniversaries of notable events, dates of the rising or setting of certain stars, short explanations of some festivals, and other matters such as are contained in a modern almanac. Several inscriptions with such lists have come down to us. Ovid's *Fasti*, of which only six books exist, are a poetical explanation of the Roman calendar as reformed by Julius Cæsar. These lists were the *fasti sacri*, while the *fasti annales*, or *historici*, were short lists of the chief magistrates for each year, and of the various notable events in it. Fragments of some of these are also preserved.

Fasting, prolonged abstinence from food and

drink, or, as in modern Christian fasting, from certain kinds of food. Such prolonged abstinences are often practised at certain times of life (especially at the beginning of manhood) by various savage races: perhaps originally because abstinence is favourable to the production of hallucination or "seeing spirits." But as moral ideas arise, the notions of self-discipline and self-sacrifice become dominant, and the fast a natural preparation for and counterbalance to the feast. Among Hindus and Mohammedans [RAMADAN] fasting is an important religious observance. It was so at Nineveh and Babylon, in ancient Egypt (in the mysteries of Isis and Osiris), and to some extent in the Hellenic and Roman religions. The Hebrew race had one annual fast prescribed to them by the Law (Leviticus xvi. 29, 34), but the zeal of later days multiplied occasions of fasting, and the practice is frequently alluded to in the Gospels. Though there is no express Scriptural command on the subject, fasting has from the first been an ordinary Christian observance. The Greek Church is very strict, both as to the length and the severity of its fasts. The Roman Catholic Church lays down precise rules, the Anglican appoints certain days but leaves considerable freedom, and though the Presbyterian Church of Scotland recognises fast days, the practice is generally omitted in Protestant churches. Two of the *Tracts for the Times* by Dr. Pusey contended for its revival, which has become very general among the High Church party during the last half century. There has been much controversy as to its value as a spiritual discipline.

Fastolf, SIR JOHN, was born about 1378 of a good Norfolk family. He entered the service of the Duke of Clarence, with whom he went to Ireland. He next joined Henry V.'s expedition into France, took the town of Meulent, was knighted, and received the companionship of the Garter. His retreat at Patay was falsely ascribed by Monstrelet to cowardice, and this may have led the great dramatist astray. In reality the conduct of Fastolf appears to have been highly commendable, and he remained in the public service until 1440. He then retired to his estates near Caister, in Norfolk, and the references to him in the "Paston" Letters and other records show that he was a remarkably wealthy man. Some attempt was made to implicate him in Cade's insurrection, very likely with a view to extorting blackmail, but he escaped this attack, and, dying at a good old age, in 1459, was buried in the Abbey of St. Bemete, Norwich.

Fata Morgana, an optical phenomenon seen in the straits of Messina. The observer facing the sea of Reggio, standing at a fair elevation with his back to the sun, will see reflected from the smooth surface of the sea a multitude of clearly defined pilasters, towers, and castles, armies of men on foot and horse, and many other multiplied images of objects existent on shore. The phenomenon requires for its manifestation a calm surface of the sea, a full and swelling tide in the centre of the channel, and a certain altitude of the sun. Special conditions of the air above may cause the

production of aerial images, and may fringe the objects with delicate edgings of the prismatic colours. Similar effects have been observed at Hastings; and on the great sandy plains of Persia, Tartary, Egypt, or Mexico, the *mirage* (q.v.) is well known. *Fata* in Italian = fairy; *Morgana* in Celtic legend is the sister of King Arthur, an enchantress living in the island of Tir Tairngire, the land of perpetual day, though enveloped in a magic bank of cloud.

Fate (Latin *fari*, to speak), etymologically a dictum or decree of the gods; but the term commonly means a force, determining the ultimate order of events, which man is powerless to resist. Very possibly this notion is originally a mythological embodiment of the "Uniformity of Nature" or Law of Universal Causation, considered as determining events and overriding the human will. As, however, the chaos of independent and conflicting deities becomes more organised in popular belief, and the conception emerges of one supreme over the rest, this law is identified with the decrees of the supreme Deity. In Greek mythology fate (*Moira*, *Éimarmenē*, "that which is portioned out") is sometimes the decree of Zeus, more commonly a destiny overriding both the gods and human affairs in the main, though with some variations. Thus (in Homer) men sometimes by their own sins suffer more than was originally appointed for them, while (in Herodotus, i. 91) Croesus (we are told) was fated to suffer, but because he had made offerings to Apollo, that god postponed the date of his downfall for three years, but explained through his oracle at Delphi that "even a god cannot escape the destiny appointed." In Æschylus, the conception of a supreme overruling destiny predominates. Sophocles tends to identify destiny with the will of Zeus. Both notions are traceable in the Homeric poems. But the conception was naturally personified. Homer sometimes speaks of one *Moira*, sometimes several, calling them also *Klōthes* ("the spinners") who begin to spin a man's fate at his birth. In the Theogony attributed to Hesiod, the fates (*Moirai*) are described as the daughters of Zeus and Themis, and sisters of the Hours, or as the daughters of Night and sisters of the Keres, the goddesses of death. They are three: Lachesis, presiding over the past; Clotho, over the present; Atropos, over the future. Clotho is depicted with a spindle, Lachesis with a scroll or globe, Atropos with scales or with shears (to cut the thread) or sometimes drawing a lot. These *Moirai* were eventually identified with the far less definitely personal Roman *Parcæ*.

The conception of Fate was taken up on its philosophical side by Herodotus and identified with the reason or natural law of the universe. Democritus denied its existence; and these rival views appear in the Stoic and Epicurean school respectively. Christian thought has taken up the notion of fate as the will of God, in Predestination (q.v.), and the conception appears in the orthodox creed of Mohammedanism, that all things happen by God's will, and it is idle for man to try to evade his destiny. The Shiah sect of Mohammedans tend to

a free-will theory. Modern scientific thought, by refusing to abstract natural laws from phenomena, and treating them not as real entities determining events, but as our formulæ expressing the order in which events happen, has eliminated most of the fatalist element from philosophic theory. But it cannot be said to have as yet satisfactorily explained the conception of moral responsibility. [FREE-WILL.] Kant regards both the belief in necessity (the scientific form of fatalism) and that in freewill as unavoidable by the human reason, but irreconcilable owing to its limitations.

Fatehgark is the fort or military station connected with Farnuckabad. It lies on the opposite side of the Ganges, and is chiefly known for the unhappy events which occurred there during the Indian Mutiny (1857) when a number of English refugees were besieged in the cantonments.

Fatehpur (City of Victory), a city in the Doab, N.W. Provinces, British India, situated on the railway between Calcutta and Delhi, 70 miles N. of Allahabad, and 50 miles S. of Cawnpore. It has some business importance, but is chiefly remarkable as the administrative centre of the district to which it gives its name. The latter has an area of 1,583 square miles, bounded on the one side by the Ganges and on the other by the Jumna. A branch of the Ganges Canal also provides means of communication and irrigation. The fertile alluvial soil yields the usual Indian crops, especially cotton, in abundance.

Father Lasher, a popular name for *Cottus scorpio* (also called the sea scorpion) and *C. bubalis*, small fishes common on the European coasts. [BULLHEAD.] The head is large, and the pectoral fins antler-like and set with spines; the general coloration is dark, with grey markings. The males are said to build a kind of nest for the spawn, and to defend the young with great fierceness.

Fathers are those eminent Christian teachers of the earlier centuries who have exercised a distinct influence in formulating and developing the doctrine of the Church. The *Apostolic Fathers* are those disciples and contemporaries of the Apostles whose works still remain to us; viz. Clement of Rome, Polycarp, Ignatius, the authors of the Epistles of Barnabas, the *Pastor* (attributed to Hermas) and the *Epistle to Diognetus*, and Papias. Of later Fathers the most eminent were:—*Greek fathers*: Justin Martyr, Irenæus, Clement of Alexandria, Origen, Athanasius, Eusebius, Gregory of Nazianzum, Chrysostom, Cyril of Alexandria, Socrates, and Sozomen, the ecclesiastical historians. *Latin fathers*: Tertullian, Cyprian, Lactantius, Ambrose, Jerome, Augustine. Roman Catholic writers enumerate as necessary qualifications for the title of Father (1) sufficient antiquity (the period is commonly extended to the twelfth or thirteenth century, so as to include Aquinas); (2) orthodoxy; (3) sanctity of life; (4) approbation by the Church. These qualifications, however, are not absolute, since the views of (e.g.) Origen and Eusebius were in some degree regarded as

heretical, and Tertullian was actually a **Montanist** (q.v.). Non-Roman Catholics writers commonly close the list of the **Fathers** with **Gregory the Great** (died 604) and **John of Damascus** (died 754). Though the writings of the **Fathers** differ much in points of doctrine and in authority, yet as they represent early and, therefore, very valuable tradition, great weight is assigned by theologians to their statements of doctrine, especially when common to several **Fathers**; but the estimate of their value varies greatly, being least usually among ultra-Protestant theologians. "Patristics," or the study of their writings, is a special branch of theology, revived in the Anglican Church by the Tractarians (q.v.). Jacobson's edition of some of the Apostolic **Fathers**, and the forty-three volumes of translations edited by Pusey, Keble, and Newman, may be mentioned among the numerous collections and editions.

Fathom (A.-S. *fæðm*, the space reached by the two arms outstretched, that being an easy measure of lengths of sounding-line), a measure of six feet, principally used in sounding depths of water.

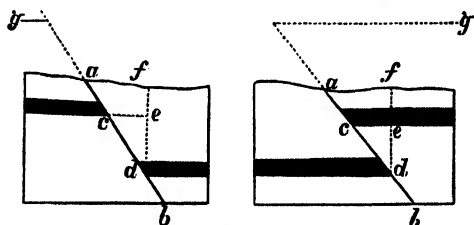
Fatty Compounds. The carbon, or organic compounds, are usually divided into two classes—the *aromatic* (q.v.) and the *fatty*. The latter are characterised, with a few exceptions, by a straight-chain arrangement of their carbon atoms, and are hence called also the *straight-chain* compounds. They comprise an almost unlimited number of substances of all varieties of type, as alcohols, acids, ketones, aldehydes, etc. One series of acids were primarily known as the *fatty acids*, owing to the occurrence of some members of series in natural fats and oils (e.g. palmitic, stearic acids, etc.). From these the name of fatty compounds were taken. The compounds are divided into *saturated* and *unsaturated*. The former may be regarded as derivatives of the group of hydrocarbons known as the *paraffins* (q.v.), which have the general formula C_nH_{2n+2} , while the unsaturated compounds are derived from hydrocarbon containing less hydrogen as the *olefines* (C_nH_{2n}), *acetylenes* (C_nH_{2n-2}), etc.

Fatwa, a town of Bengal, at the confluence of the Punpana and the Ganges, upon the East Indian Railway, eight miles from Patna. Many pilgrims visit it for the sake of bathing in the sacred river.

Faucher, LÉON (1803-1854), a French statesman and writer, was born at Limoges. He first turned his attention to archaeology and physiology, but the Revolution of 1830 drove him into journalism and politics. Between the years 1830 and 1842 he edited at different times the *Temps*, the *Constitutionnel*, and the *Courrier Français*. In 1843 he wrote for the *Revue des Deux Mondes* some articles on English industries, which were afterwards collected as *Études sur l'Angleterre*. After the Revolution of 1848 he sat for the department of Marne under the Presidentship of Louis Napoleon, and became successively Minister of Public Works and Minister of the Interior, but he resigned when Napoleon became Emperor...

Fault, in *Mining* and *Geology*, means the fracture of a stratum of rock, or of a series of strata,

accompanied by dislocation. Miners sometimes call a fault a "heave" or "trouble," or term it an "upthrow" or a "dowthrow fault," according as the bed in which they have been working is carried to a higher or to a lower level, the same fault being known by either name according to the direction from which it is approached. In geology the term *upthrow* is applied to that side of the fault on which the beds are higher, and *dowthrow* to the other side, although the actual movement of the broken strata may have been upward, downward, or both. The line of fracture, or *hade* (*ab*), is sometimes vertical, coinciding with the *throw*, but generally it is inclined. In this case it usually dips or *hades* downwards towards the dowthrow side of the fault, and faults in which this is the case are termed *normal*. A fault which *hades* towards the upthrow is termed *reversed*. In the case of a normal fault affecting horizontal strata the same bed cannot be pierced twice by a vertical shaft as



FAULT.

1, Normal fault; 2, reversed fault.

it may be in the case of a reversed fault. The actual displacement of one part of a bed by a fault with reference to the other part, measured along the hade, is called the *heave* (*cd*), and may be resolved, like any other oblique movement, into an apparent vertical displacement and an apparent lateral displacement. The latter of these apparent movements is termed the *width* (*ce*) of the fault; the former is termed the *throw* (*ed*), and is the more readily ascertained. It may amount to thousands of feet. It is, however, remarkable that the great mass of rock uplifted above the general surface in such cases (*ga*) has commonly been so planed down by denudation that faults on a gigantic scale may make no difference in the surface levels. On a small scale faults may be sharply-defined lines; but even then the harder parts of the fractured surfaces will generally be polished into what are called *slickensides*. More often the broken ends of rock are bent or crushed, the line of fault being sometimes occupied by a cemented breccia known as *fault-rock*, which may be yards in thickness. The general direction of a fault along the surface, indicated by a white line on the maps of the Geological Survey, is termed its *strike*. Faults, being fractures that have commonly resulted from the giving of rocks under similar strains to those which have folded or inclined them, often coincide either with the dip (q.v.) or strike (q.v.) of the beds—i.e. they are either parallel to, or at right angles to, the main folds, and are accordingly known as *dip-faults* or *strike-faults*. In place of a single fault we sometimes

find a succession of parallel faults close to one another, each throwing the beds a little farther apart. These are called *step-faults*. Two normal faults having in opposite directions produce what is known as a *trough-fault*. Faults are of the greatest importance in mining, since they often seriously interrupt the continuity of seams of coal or of mineral veins. They sometimes serve as pre-existing fissures to direct the intrusion of igneous dykes, or to become lined with mineral ores, and so converted into veins. Interrupting the underground drainage, they are often marked by a line of springs, either at the surface or deep-seated, as in that at Burton-on-Trent, which intercepts the gypsum-charged waters from Needwood Forest and supplies the deep wells of the Burton breweries. Bringing rocks of entirely different characters together, they are often marked by abrupt change in scenery, as in the two great faults which cross Scotland. One of these runs from Loch Lomond to near Stonehaven, over 120 miles, with a throw of several thousand feet, bringing the crystalline Archæan rocks of the Highlands against the Old Red Sandstone, and tilting the latter on end for a thickness, or breadth of outcrop, of 2 miles. This forms the "Highland line" of Strathmore. The other fault runs from Dunbar to Girvan, with a throw that amounts in some places to 15,000 feet.

Fauna, a collective name for the animals indigenous to a country or region, or of a particular geological period. The term is also applied to a treatise on either of these subjects.

Fauns (Latin *favere*, to favour, i.e. well-wishers) were Roman nature-deities attendant on the god Faunus, eventually identified with the Greek *Pan*. They are represented as half-men, half-goats, with small horns. They were frolicsome, mischievous sprites, who sometimes sent nightmare.

Fauntleroy, HENRY (1785-1824), an English banker, who was hanged for forgery. At 15 years of age he entered the bank of Marshall, Sibald and Co., and in 1807 he became a partner at the death of his father, also a partner. In 1824 it was discovered that the signatures of two trustees had been forged for the transfer of £1,000 stock, and that Fauntleroy had been paying the dividends upon it for four years. Further search discovered other like transactions, and Fauntleroy was indicted upon seven counts. He was hanged at Newgate.

Faure, FELIX, President of French Republic, born 1841, was elected in 1895. In 1897 he visited St. Petersburg to return the visit of the Czar, and while there the announcement of the Franco-Russian alliance was made. He died suddenly in 1899.

Fauriel, CLAUDE CHARLES (1772-1844), a French writer and critic, was born at St. Étienne, and educated at Lyons. He took part in the Revolution, and served for one year in the army under the celebrated Tour d'Auvergne. He then became secretary (1800) to Fouché, the Minister of Police, but, being opposed to the idea of a despotism, resigned in 1802. In 1810 he translated

some works of a Danish poet and, shortly afterwards, tragedies of Manzoni. In 1824-25 he published *Popular Songs of Modern Greece* with translation and annotations. This was during the struggle for liberty in Greece, and his work attracted much notice. The Revolution of 1830 gave him the chair of Foreign Literature at Paris. In 1836 he wrote a history of *Southern Gaul under its German Conquerors*, and he collaborated in a *Literary History of France*. He also published, with introduction and translation, a Provençal poem, which gave a history of the crusade against the Albigenses. After his death were published his *History of Provençal Poetry* (1846), and *Dante and the Origin of Italian Literature* (1854). He was on terms of friendship with Madame de Staël, Condorcet, and other noted people of his time.

Faust, a famous magician, the hero of a well-known folk-story, which has formed the foundation of puppet-plays, dramas, operas, and of Goethe's celebrated philosophic poem, the several authors enlarging or otherwise altering the original legend as suited their purpose. It is said that there was a real Faustus in the 16th century, who gave himself out to be endowed with supernatural powers, and this statement seems to be supported by valid proofs. But the hero of the legend, who sold himself to the Devil, either for the means of gratifying his passions, or for increase of knowledge, is, of course, a mythical being. The story in its present form is said to date from the dawn of the New Learning and the Reformation. This conclusion is based on the gibes at the Franciscans, and the practical jokes Faust is said to have played on high ecclesiastical dignitaries at Rome. But such gibes are by no means a safe guide, for they occur in English literature of the 14th century, and are common enough at the present day in the folk-tales of countries where the Roman faith is supreme. The Faust-legend apparently first took literary form in a German chap-book published towards the end of the 16th century, and republished over and over again. An edition dated 1846 is entitled *The Profligate Life and Terrible Death of Dr. Johannes Faust, the Arch-Necromancer*. The preface is a mere adaptation of that of the original book, and the editor assures his readers that his purpose is not to tempt men to evil lives, but to warn them of the sad consequences of commerce with the Evil One, just as in the Scriptures the lives of wicked men are recounted as examples to warn us. The book is divided into three parts, and the narrative is interspersed with moral reflections.

The first part opens with an account of Faust's birth, of "poor but honest parents." He prosecuted his studies with success, and took his doctor's degree; but his profligate habits brought him to poverty, and he turned to magic as a means of replenishing his purse. At last he resolved to raise the Devil, and this he did in a wood near Wittenberg. The operation was conducted in the following fashion:—At midnight, in the spot selected, Faust traced three concentric circles on the ground, and, having denied God, invoked the Devil three

times. Almost immediately a ball of fire ran round the circle, with a noise like the discharge of a park of artillery, and Faust was terribly frightened. But he plucked up courage, and tried another, and still another more potent charm, and at last Satan himself appeared, and asked why he had been summoned. (The folk-story does not give the



FAUST RAISING THE DEVIL. (From a German chap-book.)

formula of invocation, but this will be found in Marlowe's play of *Dr. Faustus*.) Faust told him; and the Devil, having offered to serve him, conditionally, he was conjured to come to Faust's dwelling in the morning to arrange conditions. These were that Faust should deny God and every thing good, and then he was promised for the space of twenty-four years the means of indulgence in every earthly pleasure. Faust agreed, and with his own blood signed a compact embodying these conditions. The Devil thereupon appointed Mephistopheles (q.v.) to be Faust's servant and familiar, and with this spirit the Doctor was wont to inquire about spirits, heaven, the angels, and once he asked his familiar if the devils would be saved. In reply Mephistopheles quoted St. Paul (Romans xi. 32), as affording them strong ground of hope. Then they discoursed of hell. The remainder of the first book is taken up with an account of Faust's skill as an astrologer and seer, his luxurious mode of living; how he carried three students to Munich on his cloak, rode out of the wine-cellar at Auerbach on a cask; and raised up Menelaus, Achilles, and other heroes for the gratification of some students. Mixed with these adventures is a series of coarse practical jokes, some of which find a place in the low comedy scenes of Marlowe's *Dr. Faustus*.

The second book opens with the story of Faust's half-hearted repentance. The Devil, however, appeared to him and terrified him into signing a second compact. Then Faust engaged Wagner as his amanuensis. The chief incidents in this book are the aerial hunt which Faust showed Cardinal Campeggio, "foxes and hares running in

the sky, Mephistopheles mounted, and in hot pursuit, whilst Faust blowing a huntsman's horn, brought up the rear"; the raising of Alexander the Great and his consort, the procuring ripe fruit in winter, the magical concourse of singing birds, the building a castle and banqueting hall, the raising a dead man to life, and Faust's *liaison* with Helen of Troy, by whom a son was born to him.

In the third book we see the end approaching. Faust has made his will, leaving all his property to Wagner, and charging him to write a full account of his master's adventures, which was not to be made public till after Faust's death. Soon after this the Devil appeared to Faust, telling him the end was near. Wagner tried to comfort him, and to induce him to send for a clergyman. At last Faust did so, and the good man comforted him, and advised him not to argue with the Devil, but to bid him begone. Faust promised to follow this advice, but when the Devil appeared, and began to dispute, Faust answered him, and, as might be expected, got the worst of the argument. Then he tried to commit suicide, "but invisible hands took the knife away from him," and soon after he died in his chamber without a friend near him. "And when they entered the room they saw that the walls and the table and the chairs were covered with blood; for the Devil had dashed him first against one side of the room and then against the other."

Marlowe followed the folk-story pretty closely: and his Faust is a man; the Faust of Goethe's poem is an abstraction, and from the "Prologue in Heaven" one gathers that the German poet intended his Faust to be a second Job, and believed with Longfellow that Lucifer is God's minister. Marlowe's *Faustus*, according to Lamb, was "busied in speculations that are the rottenest part of the core of the fruit that fell from the tree of knowledge;" Goethe's Faust wants to know the "causes of things" (cf. Verg. *Georg.* ii. 490). Commentaries almost numberless have been written on this poem, yet it should be its own interpreter, and will reveal its meaning to the man who diligently studies it.

The idea of a compact between man and the Devil dates from early Christian times; and it was the belief of some of the Fathers that a knowledge of magic and alchemy was imparted to man by the fallen angels, and "all that miserable knowledge which is of no use to the soul" was ascribed to the same source.

Faustina, (1) ANNA GALERIA, wife of Antoninus Pius, d. 141; (2) called FAUSTINA JUNIOR, to distinguish her from the former, was the wife of Marcus Aurelius, the philosopher. Both these ladies have been credited with great profligacy of life, but these stories are doubtful, and in any case they seem to have enjoyed the full esteem and affection of their husbands.

Fauvette. [WARBLER.]

Favart, CHARLES SIMON (1710-1792), a French dramatist, born at Paris. His first work to be performed was *La Chercheuse d'Esprit* (1741). In 1745 he became director of the Opéra Comique, and managed to offend other theatres, whose jealousy

raised many obstacles in his path. Another noted play of his was *Le Coq du Village*. He is looked on as the creator of French serio-comic opera, and his works were collected into 10 volumes in 1810. In 1809 his *Mémoires et Correspondence* was published.

Faversham, a municipal borough and port of North Kent, upon the river Swale, 52 miles S.E. of London and 10 miles N.W. of Canterbury. It consists mainly of four streets with a market-place in the centre. The creek upon which it is situated admits vessels of 200 tons, and there is a trade in corn, hops, fruit, and wool. The oyster cultivation of Faversham is renowned, and there are manufactures of powder and of Roman cement in the neighbourhood. There is a fine cruciform church, which contains the supposed tomb of King Stephen, and there are schools, a literary institute, and a reading-room. Some ruins remain of a Cluniac abbey, founded in 1147; and James II. embarked here after his abdication. Pop. (1901), 11,290.

Favositidae, an extinct family of corals belonging to the Perforata (q.v.), which lived only in Palæozoic (q.v.) times.

Favre, JULES CLAUDE (1809-1880), a French statesman, was born at Lyons. He studied law at Paris, and was admitted to the bar. He was an advocate of republicanism, and took part in the Revolution of 1830, and again in that of 1848. He was elected deputy for the department of Loire, and became a member of the Committee on Foreign Affairs. He led the Mountain (q.v.) against Louis Napoleon after the *coup d'état*, and then retired from politics and practised law. In 1858 he defended Orsini when on his trial for an attempt to kill the Emperor. He again entered the Legislature as member for Paris, and headed the Republican party. On the downfall of the Empire he was appointed (1870) Minister of Foreign Affairs; and his neglect or mistake in 1871, in permitting the Paris National Guard to retain its arms, gave opportunity for the Communistic outbreak, and in his negotiations with Bismarck he failed to include General Bourbaki's army in the conditions. These and minor mistakes led to his retirement, and he returned to his practice of the law. He was a good and effective speaker. He was elected to the Academy in 1867.

Favus, a skin disease produced by the growth of a fungus known as the *achorion schönleini*. The disease usually affects the scalp, and produces yellow, irregular crusts, and leads to the falling off of the hair. It is more frequently met with in children than in adults, and is rare in England, but not uncommon in Scotland. Treatment consists in poulticing and washing the affected parts, and when cleanliness is secured in applying remedies to kill the parasite.

Fawcett, HENRY (1833-1884), an English minister and writer upon political economy and social subjects. His father was a magistrate of Salisbury. Mr. Fawcett was educated at King's College School, London, and at Trinity Hall,

Cambridge, of which society he became a fellow after graduating as 7th wrangler in 1856. In 1858 an accident, while he was out partridge shooting, led to the total loss of sight. With characteristic determination and strength of mind, Mr. Fawcett forwent few if any of his accustomed recreations and occupations; he rowed, rode, and skated almost to the end of his life, and remained as useful a member of society as he had been before the accident. He wrote many articles in magazines upon politics and upon political economy, and his *Manual of Political Economy* led many to study the subject who had found earlier manuals too technical and abstruse. In 1863 he was appointed Professor of Economy at Cambridge. He wrote many works upon that and kindred subjects, receiving much valuable aid from his gifted wife. After three vain attempts to enter Parliament, he was returned for Brighton in 1865 and again in 1868, and for Hackney in 1874. In 1880 he was made Postmaster-General, and his period of office was marked by the establishment of the parcel-post, the reply-postcard, and by other improvements in different departments. While in Parliament he devoted much attention to Indian questions; and it was probably only his blindness that prevented his admission to the Cabinet. A life of him has been written by Mr. Leslie Stephen. His wife, MILLICENT GARRETT FAWCETT, is the daughter of Mr. Newson Garrett; she was married in 1867, and, as has been stated above, largely assisted her husband in his pursuits and occupations. She published a work on *Political Economy for Beginners*, in 1869, consisting of a compendium of the *Manual* of Professor Fawcett. She is a strong upholder of Women's Rights, and has lectured much in favour of the extension of the suffrage to women.

Fawkes, GUY (1570-1606), was born at York. Though brought up an Anglican, he became a Roman Catholic through the influence of his stepfather, who was of that faith. For some time he served as a soldier of fortune in Flanders and elsewhere, and seems to have been a man of good parts and qualities. His part in the plot of Catesby and others to destroy the king, James I., and Parliament, in which the critical operation of "belling the cat" fell to his lot, is a matter of well-known history, as is its failure and direful results to the conspirators.

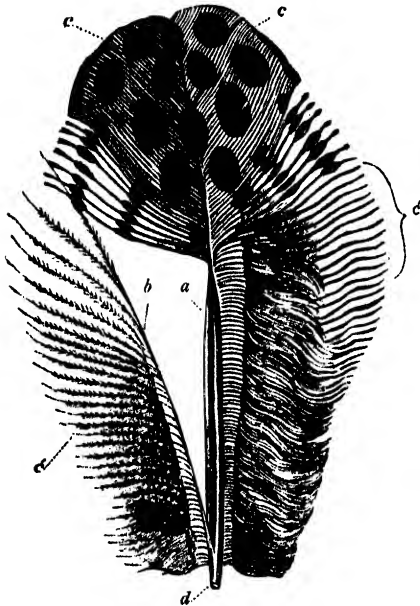
Fay, ANDRAS (1786-1864), a Hungarian author and poet, was born at Kohany, and was educated to the law. Ill-health compelled him to quit that profession and take to literature. In 1820 he published a collection of *Fables*, which gained for him the name of the "Hungarian Æsop." He had already published a *Nosegay* in 1807 and a *Fresh Nosegay* in 1818, and among his works are many other tales, plays, and romances. In 1835 he represented Pesth in the Hungarian Diet. He is the founder of the Hungarian National Theatre.

Fayyum, a province in the N. part of Central Egypt, separated by mountains from the Libyan desert. The area is 500 square miles, of mostly alluvial formation, and, in the north, generally fertile. The west is now covered with sand, and

contains the lake Birket-el-Karun. There are irrigation canals, but these are not fully used, and the province languishes. Rice, barley, rye, and flax are the principal objects of cultivation, and there are cotton factories, while the linen of Fayyum enjoys great renown. Caravans go from the province to Cairo, carrying shawls, linen, otto, dates, etc. The chief town is Medinet-el-Fayyum.

Fear, CAPE, the southern point of South Carolina, is situated at the southern extremity of Smith's Island, on Cape Fear river, at the mouth of which is a lighthouse, with a light fixed at the height of 110 feet. The river runs S.E., with a course of 250 miles, and is navigable for steamboats for half that distance.

Feathers, the distinctive covering of Birds (q.v.), developed like the hair of Mammals and the scales of Reptiles and Fishes as outgrowths from the skin. Those which determine the shape of a bird are called contour-feathers or *pennæ*, but except in the ostrich (q.v.) and its close allies, the



CONTOUR-FEATHER OF THE ARGUS PHEASANT.

a, Shaft or rachis, with barbs on one side removed to show aftershaft or hyporachis b, from which the barbs on the opposite side have also been removed; c c, barbs; d, barbs separated to show barbules; d, quill.

Penguins, and a few other birds, these are not distributed evenly over the body, but in patches called *pterylae*, and between these the skin is either bare or covered with down, and these interspaces are called *apteria*. In many birds powder-down patches occur; these are tracts covered with small down feathers, giving off a white or bluish dust, the origin of which is not satisfactorily established

(Nitzsch: *Pterylography*). Feathers are of various kinds: the most important are the contour-feathers, consisting of a main shaft or stem, divided into the true shaft or *rachis* (a), and the quill or *calamus* (d). From the former radiate the barbs or *rami* or *radii* (c c), and these, with the true shaft, form the vane or *vevillum*. The spaces between the barbs are filled by the barbules (d'), which bear the same relation to the barbs that these bear to the main stem. Generally speaking, the ends of the barbules are hooked, so that those springing from one side of the barb interlock with those of the barb next above or below, and it is to this arrangement that the web-like structure of each side of the vane is due. Barbules, however, do not occur in any of the feathers of the Cursorial Birds, and only in the contour-feathers of other birds. In many feathers there is an accessory vane, called the aftershaft or *hyporachis* (b) springing from the under side, near where the quill passes into the true stem. This aftershaft may be as long as the vane, though it is generally much smaller, or it may be reduced to a mere downy tuft. When the barbs are soft and free, the feathers are called plumes (*pennoplumæ*), or down feathers (*plumulae*), according as the shaft is largely developed or not. A feather with a long shaft and small vane is called a *filoplume*.

Feathers are developed within sacs from the surface of conical dermal papillae, by a process that Professor Huxley compares to casting in a mould, and appear first as embryonic down-feathers, which are soon replaced by the permanent feathers formed in a similar way. The life of a feather is generally only a year, when the nutrient pulp in the quill decays, and the feather dies and is shed. This process of shedding the feathers generally takes place when the breeding season is over, and is called moulting.

Besides their uses as body covering and means of flight, feathers serve as sexual attractions, and in some cases as means of producing love-calls, as the "bleating" of the snipe, the rattling of the quills by peacocks and birds of paradise, and the "drumming" of the North American grouse.

The commercial importance of feathers is very great. The down of the Eider-duck (q.v.), and the feathers of swans, geese, and poultry are very largely used, the first for quilting articles of clothing, and the second for stuffing beds and pillows, and cushions. Despite the Selborne Society (q.v.), vast numbers of gay-plumaged birds are annually killed for trimming hats and bonnets, and the plumes of the Ostrich and the Marabout Crane figure for a large sum in our list of imports, while other birds are warred upon to provide muffs and feather-trimmings. [QUILL.]

Feather Star. [ANTEDON.]

Febrifuge, a medicine employed to reduce the temperature of the body in fevers. [ANTI-PYRETICS.]

February (Latin *Februarius*, from a festival of the god Lupercus or Februs, part of the Lupercalia, held on the 15th of the month), the last month of the Roman year until Cæsar's reforms. The addition of January and February to the original

Roman year of ten months is attributed to Numa. [CALENDAR.]

Fécamp, a Norman seaport on the English Channel, in the department of Seine-Inférieure, at the mouth of a river, 23 miles N.E. of Le Havre. It is built in a narrow valley opening between two cliffs, and consists principally of one street of two miles in length, and is marked by a lighthouse. There is an inner harbour with a quay, and there is a considerable trade in Baltic and colonial produce. Many of the inhabitants are employed in the whale, cod, herring, and mackerel fisheries. There are cotton- and oil-mills, sugar refineries, etc., and the Abbey produces the renowned Benedictine liqueur.

Fechner, GUSTAV THEODOR (1801-1887), a German physicist and psychologist, studied physics at Leipzig, and became Professor of Physics in 1834. In 1828 he published a *Handbook of Experimental Physics*, and made researches into the theory of colour, and in the nature of galvanism upon which he published a work in 1831. In 1860 appeared his *Elements of Psychophysics*. He was also the author of essays and of poems.

Fechter, CHARLES ALBERT (1823-1879), a well known actor, was born of an English mother, his father being a Frenchman. He went when a child to France, where he was trained as a sculptor, but took to the stage. He made his *début* in 1840, and in 1860 he made his first appearance upon the English stage, where he played *Ruy Blas*. He then played Shakespeare, and his Hamlet and Othello attracted much attention, partly from his departure from the old traditions as to how the parts should be handled, and partly owing to his foreign accent, which pleased some and displeased others. He became for a time lessee of the Lyceum, and in 1872 he went to America. His managerial career in America was not a success. He died in Pennsylvania.

Federalist Party, THE, in the history of the United States, arose soon after the Revolution, chiefly among the trading and capitalist classes who desired a strong central government and restriction of State rights. Washington, Adams, Hamilton and (at first) Madison were all Federalists, and the series of papers by the two latter and John Jay, published in the *New York Independent Journal* and afterwards republished under the title of the *Federalist*, did much to aid the transformation of the Confederation into a Federal Union. The chief strength of the party was in New England. It disappeared about 1812 from Federal politics, chiefly from its opposition to the war with England, though it lasted some years longer in State politics, in Massachusetts and elsewhere. It favoured the development of infant industries by protection.

Federation is defined by Professor E. A. Freeman as "any union of States stronger than mere alliance, but whose members enjoy more than merely municipal freedom." Federations in this wide sense are either confederations (the states composing which retain their full sovereignty, but are in permanent

alliance) or federal unions, in which each state delegates certain of its sovereign powers to a central government, including the management of foreign relations, military and naval matters, certain powers of taxation, e.g. as to levying customs duties, and the right of legislation on certain specified subjects. All powers not specifically delegated remain vested in the governments of the separate states. Thus divorce is very easy in Indiana, but is not recognised at all in South Carolina; but neither state can impose customs duties or adopt a monarchical form of government. Normally, a federal union (to which the term federation is often confined) implies a written federal constitution, and a court or other central authority to expound it. Some external danger which the members could not resist singly, a high degree of similarity, and an approximate equality between all or many of the members, are usually conditions of federation. The Achaean League in antiquity, Switzerland, and the United States, are leading instances of federal republics, the German Empire (which is, however, controlled by Prussia) is a federal monarchy, and many persons hope that the British Empire will one day be a federal union.

Fee Simple, FEE TAIL. [ESTATE.]

Fees are particular sums of money claimed as their perquisite by official persons under authority of Act of Parliament, prescription, etc. The right to fees, as well as the amount of them, has in many cases been regulated by statute. Officers demanding improper fees are guilty of extortion. [EXTORTION.] The honoraria paid to counsel and physicians for their services are also termed fees; but they cannot be recovered by legal proceedings, while solicitors', surgeons', and surveyors' fees can be legally sued for. There are also school fees and surplice fees. As to school fees they are prescribed by the "Elementary Education Acts;" and as to surplice fees, they are not due to the minister as of common right, but depend on special custom only; while as to Easter offerings, it has been laid down that they are due of common right to him who exercises the spiritual functions of the parish, and that at the rate of twopence a head for all the parishioners of the age of 16 years and upwards. [OBLATIONS.]

Fehling's Solution, a reagent which is largely employed for the volumetric estimation of glucose, or grape sugar. It is prepared by dissolving copper sulphate, Rochelle salt, and caustic soda in water, in definite proportions. The solution of the two latter is kept separate from that of the copper salt, and only mixed when required for use. When a solution of grape sugar is added to this reagent, heated to boiling, a red precipitate of cuprous oxide Cu_2O is formed, and the blue colour which the reagent possesses is discharged. When sufficient sugar solution has been added to completely discharge the colour, the reaction is complete. The reagent is generally made of such a strength that 10 cc. are equivalent to .05 dram of glucose. If cane sugar has to be estimated, it must be first converted into glucose, this being performed by treatment with a dilute acid.

Felli (i.e. Rebels), the collective name of the Luri-Kuchak Lurs, that is, of the Lurs of Little Luristan, province of Khuzistân, West Persia. They form the Pusht-i-Koh division of the Luri family, and, according to Macgregor, their numerous clans fall into seven main groups: Kurd, Melaki, Shahan, Panj Sitân, Donarwand, Lort, and Handemani, and on these are dependent the Bajllan, Beiranwand, and Hulilani, all belonging to the aboriginal Kurdish stock of the West Persian highlands—the Kar-duchi of Xenophon. But it should be noted that too wide a meaning has been given by Layard, and after him by Macgregor, to the Felli branch, under which they include the Pesh-Koh as well as the Pusht-i-Koh, the former being the collective name of the Lurs proper. [LURS.]

Fellth, RHYNVIS (b. 1753), a Netherland poet, born at Zwoll in Overysse. He studied law at Leyden, and in 1770 returned to his native town, of which he became burgomaster. His style was melancholy and sentimental. Among his works are a poem on *De Ruyster, The Grave (Het Graf)*, *Old Age (De Ouderdom)*, *Oden en Godichten*, and he collaborated with Bilderdijk in *De Geuzen (The Beggars)*, as the party of freedom in the 16th century were called. A collection has been made of his letters also.

Felidae, the chief family of the *Eluroidea* (q.v.), containing the typical specimens of the Carnivora, and dating back to Eocene times. Some of the extinct forms were highly specialised, and in some respects more so than the living species, which Dr. Mivart is inclined to rank as "the very flower and culmination of the mammalian animal tree." The living family comprises two genera: *Felis*, with sixty-six species, and *Cynelurus*, with a single one. [CHEETAH.] Some authorities also make a separate genus of the Lynxes, which are almost peculiar to the Nearctic and Palaearctic regions. [LYNX.] The distribution is nearly universal, only the Australian region, Madagascar, and the Antilles being without representatives. The members of the family walk upon the tips of the toes, the whole heel and metacarpus being raised above the ground; and the soles of the feet are furnished with soft, cushion-like pads, that not only render progression noiseless, but serve to break the shock of the prodigious leaps taken by these animals in pursuit of their prey. There are five digits on the fore limbs, and four on the hinder ones, all armed with strong, sharp-curved, and highly-retractile claws, that form terrible weapons for disabling their prey and tearing it to pieces. The body is long and lithe, the skull rounded, and the limbs characteristically short, except in the Cheeta, whose legs are so long as to suggest relationship with the Dogs, to the observer who judges from appearances only, and in the Lynxes, in which group the tail is also short and the ears are furnished with a tuft of hair at the tip. The dental formula is $i \frac{3}{1}, c \frac{1}{1}, p \frac{3}{1}, m \frac{1}{1} = 30$. The canines have cutting edges and sharp points, and the premolars are well adapted for cutting, and act against each other like the blades of a pair of scissors. [CARNASSIAL TOOTH.] The tongue is

covered with strong, horny papillæ, bent strongly backwards, and forming an efficient natural rasp to clear the flesh from the bones of the prey. The eyes are large, and under the influence of strong light the pupils become contracted to a mere slit in some species, and in others to a tiny hole. Most of the species are nocturnal, and more or less arboreal, with the exception of the lion and tiger. Their food is the flesh of warm-blooded animals, which they kill for themselves. The Fishing Cat (*F. viverrina*) will catch and eat fish and fresh-water molluscs, but all the rest have a great dislike to water, though many of them lurk in tall vegetation near lakes and rivers, so as to spring upon unwary beasts as they come to drink. No species is social, nor do they ever hunt in packs like the Dogs. They stalk their prey, and, having approached as nearly as may be without being discovered, rush upon it with a terrific spring, and, knocking it over with a blow of the fore limb, either carry it off or kill it on the spot. The senses are extraordinarily acute, though scent is not so keen as in the Dogs. Although intensely savage, all can be tamed if taken young, though the task is one that requires patience. But the "performing lions and tigers" of travelling menageries are cowed rather than tamed, as is shown by the untimely end of many "tamers" of both sexes. The coloration of the family is various; but the uniform tints of the lion and puma, the stripes of the tiger, and the spots and markings of the leopard and smaller cats are protective, and harmonise well with the surroundings of the animals in their natural habits, though at first sight this would scarcely seem to be the case. Young lions and pumas are also marked with feeble stripes or rows of spots, pointing to descent from an ancestor that was not uniformly coloured. [CARACAL, JAGUAR, LEOPARD, LION, OCELOT, OUNCE, PUMA, TIGER, etc.]

Felix, CLAUDIUS (1st century A.D.), a Roman procurator of Judæa, brother of Claudius's favourite, Pallas, and, according to Tacitus, profligate and unscrupulous. He lived in adultery with Drusilla, the wife of another. He it was who trembled when St. Paul spoke of a judgment to come. He was recalled in A.D. 63, and was in danger of being found guilty of charges of maladministration brought against him by the Jews.

Felix, MARCUS MINUCIUS, a Roman lawyer, who is thought to have lived in the 3rd century A.D. He was a Christian, and wrote an apology for the faith, called *Octavius*.

Fell, JOHN (1625-1686), was the son of Dr. Samuel Fell, Dean of Christ Church. He was educated at Christ Church, where he graduated in 1640. He at first took service in the Royal garrison, but afterwards was ordained, and was ejected during the Commonwealth, and retired into private life. At the Restoration he was made Dean of Christ Church, and in 1666 he became Vice-Chancellor; and his strict discipline gave occasion to the well-known epigram. [EPIGRAM.] He founded the University Press, and added much to the buildings of Christ Church. In 1676 he was made Bishop of

Oxford, still, however, retaining the Deanery of Christ Church. He was a man of the old school, and did not approve of the newly-founded Royal Society. He translated Wood's *History and Antiquities of Oxford*, and was buried in the cathedral.

Fellahin (plural of *Fellah*, a labourer or peasant), the collective name of all the agricultural as opposed to the pastoral or nomad Arabs (*Bedāmin*), but applied in a special and somewhat contemptible sense to the peasantry of Egypt and Syria, most of whom are not originally Arabs, though now speaking Arabic. The Fellahin live in villages under the government of a Sheykh-el-Beled, who has to see that their taxes are regularly paid to the Nazir or governor of the district. A Fellah may rise to the position of Sheykh or Nazir, but the governors of provinces are invariably Turks. The villagers are miserably poor, and suffer cruel treatment at the hands of the Turks. The taxes are excessive and uncertain, and the governors often extort more than the legal amount. The condition of the Fellahin in this respect has, however, somewhat improved during the British occupation. Although their food is scanty—consisting chiefly of bread made of maize or millet, eggs, and raw vegetables, or in the case of the very poor of coarse bread and the mixture called “*dukkah*”—they are remarkably vigorous, and capable of undergoing great fatigue. They usually marry as soon as they can afford a dowry, as they are glad to obtain the assistance of a wife and children on their farms. They are described as affectionate parents, but when reduced to great poverty they are sometimes induced to sell their children to their fellow-villagers. The term is also applied, though apparently not in a depreciative sense, to the eight tribes of the Nisibin district in the Middle Euphrates valley, who are now subject to the powerful Shamūr Arabs. These are the Sebūr, Baggara, Sherābrin, Khudhr, Harb, Hadidrin, Albu Aāsī, and Ghassameh, in all 52,000.

Fellows, SIR CHARLES (1779–1860), traveller and antiquary, was born at Nottingham. As a youth he travelled much, and then settled in London in 1820. In 1827 he visited Switzerland, Italy, Greece, and the Levant, and some of his sketches were utilised to illustrate *Childe Harold*. In 1838 he made some important discoveries in Asia Minor, and brought back from Lycia marbles that are now in the British Museum. He was knighted in 1845, and passed the latter part of his life in the Isle of Wight. Among his works are *Travels and Researches in Asia Minor* and *Coins of Ancient Lycia*.

Fellows of Colleges generally form the governing body, and are paid out of the college revenues. Since 1880 there have been two great classes at Oxford and Cambridge—Prize Fellows, elected usually after examination, and Official Fellows. The latter are required to reside in the college or university, and take part in tutorial or other work. Celibacy is now seldom enforced. Usually the appointment is for a term of years.

Felo de se (a felon of himself) is one who, being of sound mind and years of discretion,

deliberately causes his own death, and also, in some cases, where one maliciously attempts to kill another, and in the carrying out of such attempt unwillingly kills himself, he is adjudged a *felo de se*. When the deceased is found by the coroner and jury a *felo de se*, all his chattels, real and personal, are forfeited to the Crown, though they are usually restored upon payment of moderate fees. A will made by a *felo de se* is void as to his personal estate, though not as to his real estate, nor is his wife barred of her dower. Formerly he was buried in the highway, with a stake driven through his body; but by 4 Geo. IV., c. 52, it is provided that a *felo de se* shall be privately interred at night in the burial-ground in which his remains might by law have been interred if the verdict of *felo de se* had not been found against him. The Intermments Act, 1882, repealed and re-enacted the above Act, omitting the provisions as to the hours of burial, and allowing, by permission of the ordinary, a religious service, the Prayer Book expressly forbidding the use of the Burial Service therein contained in the case of those who die “laying violent hands on themselves.” A coroner’s inquest must be held in every case of suicide, and in the absence of evidence of unsoundness of mind, the verdict of *felo de se* must still be directed and returned. To attempt to commit suicide is a misdemeanour at common law. [CORONER, FELONY.]

Felony is any capital crime short of treason, and being such as occasioned, at common law, the forfeiture of the felon’s lands and goods. The word “felony,” in its generic sense, includes even treason, and under particular statutes the offence of treason may be dealt with as a felony. All indictable offences are either felonies or misdemeanours; but a material part of the distinction is taken away by 33 & 34 Vict., c. 23, which abolishes forfeiture for felony, and provides for the administration of the estates of felons while undergoing sentence. The crime of felony may be said to stand half-way between treason and misdemeanour. As to its consequences to the felon, *see* ATTAINDER, ESCHIEAT, FELO DE SE.

Felspar, the name of a group of closely related and intimately associated mineral species, the most abundant of rock-forming minerals. They are silicates of aluminium together with silicate of potash, soda, or lime, often coloured by iron-oxides; their hardness is about 6, or that of glass; and their specific gravity ranges from 2.54 to 2.76. They are divided into the *Orthoclastic*, Oblique, or Monoclinic, which yield cleavage forms with some pairs of faces at right angles, and the *Plagioclastic*, Anorthic, or Triclinic, which do not; or, chemically, into the more *acid*, containing over 60 per cent. of silica, and having a specific gravity not exceeding 2.7, and the more *basio*, containing less than 60 per cent. of silica, and having a specific gravity over 2.7. The acid felspars are the more insoluble in acids and the more infusible, and are especially abundant in the plutonic rocks, in which they are associated with free quartz, hornblende and mica. The basic felspars are more characteristic of the volcanic rocks, in which they are associated with augite, but

rarely with free quartz or hornblende. Most mineralogists now follow Tchernak in considering only three true species of felspar to exist, viz. *orthoclase*, or potash-felspar, *albite*, or soda-felspar, and *anorthite*, or lime-felspar, the other forms being varieties or twin-combinations of these. *Orthoclase*, a potash-felspar, crystallises in oblique rhombic prisms. When transparent and colourless it is known as *adularia*, or if with a bluish opalescence as *moonstone*, both of which forms are gems. More often it is nearly opaque, perhaps from partial hydration, and tinged with a salmon-pink, in which condition it is an abundant constituent of granite, felsite, eurite, and gneiss. It often occurs in large "porphyritic" crystals several inches long. It decomposes into china-clay, or kaolin (q.v.). *Sandine* is a glassy, translucent variety containing some soda, and characterising trachytes and liparites. *Microcline* is a potash-felspar differing slightly in angle, thus becoming plagioclastic: *amazon-stone* is a valuable green variety. *Albite*, or soda-felspar, named from being generally white, is plagioclastic, but acid. It occurs in many diorites, syenite, and occasionally in granite. *Anorthite*, the lime-felspar, is also white and plagioclastic; but is basic, fusible, soluble in acid and heavy. It occurs in some gabbros and other basaltic rocks. *Oligoclase*, or soda-lime-felspar, is probably a combination of albite and anorthite, in which the former predominates; *andesine*, or soda and lime-felspar one in equal proportions; and *labradorite*, the lime-soda felspar, one in which anorthite predominates. Oligoclase commonly occurs with orthoclase in Scotch grey granites; andesine, in the basaltic rocks known as andesites from their occurrence in the Andes; and labradorite—which is often dark-coloured, and exhibits on some faces beautiful change of colours, blue, green, yellow, red or brown, from included fibres—in basalts, gabbros, and hypersthénites.

Felt, a fabric produced by the adhesion of the fibres of hair and wool, without any process of weaving. Hair has a serrated surface, the barbs pointing towards the upper extremity, so that when a mass of hair is subjected to pressure the barbs of one hair become firmly fixed in the indentations of another lying in the opposite direction. Wool felts more easily than ordinary hair owing to its tendency to curl, but the natural grease must be previously abstracted. Felting is probably an older invention than weaving; it was used at a very early date by the Armenians and Tartars in the manufacture of clothing and tent-covers, and is mentioned by Xenophon, Pliny, and Marco Polo. Moisture, as well as pressure, is necessary in felting, and heat is also serviceable. Thus in the manufacture of carpets, articles of clothing, and similar commodities, the process is as follows:—The wool is first of all carded out into a number of fine laps of the required length and breadth; these are then placed one upon the other until the desired thickness is obtained. The mass of wool is then moistened and passed between rollers, some of which are heated internally with steam. This is the final stage in the production of the felt,

which is afterwards dyed, printed, or otherwise adapted to its purpose. The most extensive felting industry is the manufacture of hats. A coarser kind of felt is used for various mechanical appliances, such as covering steam boilers, polishing wheels, pianoforte-hammers, etc. In such cases cow-hair is often the chief ingredient. The "asphalted felt" used in roofing is felt of a coarse quality which has been immersed in asphalt, pitch, or coal-tar.

Felton, CORNELIUS CONWAY (1807–1862), was educated at Harvard, where he became Professor of Greek in 1834 and President in 1860. His best known work is *Greece, Ancient and Modern*.

Felton, JOHN (1595–1628), the assassin of the Duke of Buckingham (q.v.). The elder Dumas has made an important figure of him in *The Three Musketeers*.

Felucca, a small ship with two masts and a lateen sail, common in the Mediterranean. It sometimes has a rudder at both ends.

Fuláp (properly FULŰP), a Negro people of Senegambia, whose territory extends along the Atlantic coast from the Gambia river south to the Cacheo (Kajiu) river. It is thus mainly limited to the Casamanza basin, though it appears to have formerly extended to the Geba and the Bissagos Islands, some 70 miles farther south. Fuláp was originally the name of a single tribe, which was later extended by the Portuguese traders to the Yola, Ayamát, Jigúsh, Karon, Vaca, Joat, Banyún, Banjar, Bayot, and all the other kindred tribes, who jointly with the Sereres, Filhams, Bolas, Pepels, and Kanyops of the Rio Grande, form a Negro family distinct at least in speech from all the other natives of Senegambia. The Fuláps proper exhibit all the physical and moral characteristics of the typical Negro in an almost exaggerated form. The complexion is decidedly black, the face flat, the nose flat and broad at the base, the lips very thick and everted, the hair short and woolly and absent from the face, the figure rather short but strong and muscular. There is no tribal cohesion, every village being independent, and mostly at war with its neighbours. Even the family is scarcely developed, promiscuous unions being still everywhere prevalent. The kidnapping or sale of children is also universal, and the passion for drink is carried to an excess elsewhere unknown. The people go naked, armed with the bow and arrow, and live in log huts, which are substantially built, but indescribably filthy. (Bertrand-Bocandé, *Sur les Foulaps ou Féloups*, *Bulletin de la Soc. de Géographie*, 1849.)

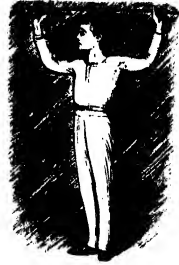
Felygyhaza, a town of Hungary, 66 miles S.E. of Pesth. It has a fine town-hall, and is noted for its great cattle-market. In the neighbourhood are vineyards, and fruit, corn, and tobacco are cultivated. Many Roman urns and other relics have been found. The town was destroyed by Turks in the 17th century, and for many years remained desolate.



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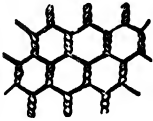
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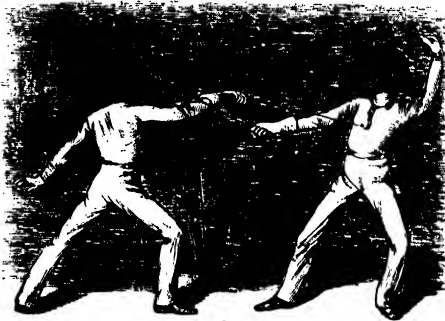
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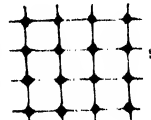
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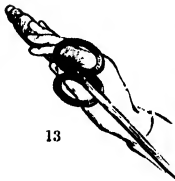
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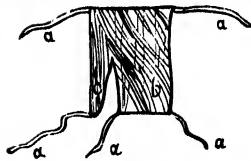
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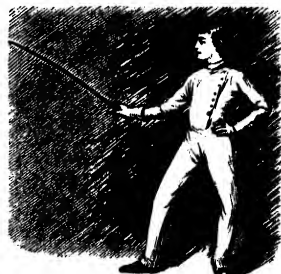
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FENCING.

1 Slope Sword. 2 The Lunge. 3 Correct Attitude—second position. 4 Hand in Supination. 5 How to hold the Foil. 6 Hand and Hilt during the "Salute." 7 Hexagonal Mesh for Masks. 8 Thrust in Tierce. 9 Unsafe Wire-work for Masks. 10 Hand in Pronation. 11 Thigh Piece. 12 Position of the Hand in Longeing. 13 Hand and Hilt during the "Salute." 14 Fencing Jacket. 15 Resting on the Lunge—point towards shoulder. 16 Hanging Guard. 17 Outside Guard.

Femur, the bone of the upper part of the leg. It articulates by its head or upper portion with the ilium, forming the hip-joint, and enters at its lower portion with the tibia into the formation of the knee-joint. The femoral artery is the main arterial trunk of the thigh.

Fences are used in agriculture to prevent cattle from straying, and to protect land from the inroads of stray animals. Among the rudest kinds of wooden fence is the snake-fence, which is simply made by laying logs together so as to form a zig-zag line. When wood becomes scarce the fence is formed by laying rails horizontally across stobs fixed in the ground at intervals of two or three yards, to which they are attached by nails. The stob-and-rafter fence is a firmer but more expensive structure, consisting of stobs three or four inches apart, bound by a rail which runs along their upper extremity. In America rails are often split and sharpened so as to fit into openings in the stob. In old countries, where both wood and stone are scarce, their place is taken by hedges of plants, the hawthorn being commonly used in England. Wire fences are now common both in England and in Australia. In England it is incumbent on the tenant to keep and leave fences in due repair, but if he erects a wire or other temporary fence he may remove it if he can do so without injuring the ground.

Fencing. The art of fence (or of defence, as it was more commonly termed in earlier days), taken in its broad sense, means the art of wielding hand weapons for attack and defence. The attack is rightly included in the definition, for in no mode of fight is real "defence" possible without its combination with "offence." Thus the word *fencing* would refer to all scientific hand-to-hand fighting, including such branches as boxing and cudgelling. By convention it has, however, at all times been applied only to steel weapons retained in the hand, swords of all kinds, daggers, and hastate implements of war. In later days "fencing" has been restricted, in general use, to the dexterous management of the sword; and in England the meaning of the word is still further confined to mere foil-play.

As a matter of fact, the broad principles of the art of fence are the same for all hand weapons. They can, however, be put into practice to the greatest perfection of neatness and accuracy with light and well-balanced implements, like the modern duelling swords and sabres.

The historical evolution of the "theory" concerning the essence of true *dexterity in arms* illustrates well wherein perfection lies; the improvement in the rules of fence have always been in the direction of simplicity.

In England we had long a very excellent, sturdy, if somewhat rough, method of broadsword play, but the wielding of the rapier in Elizabethan days and of the small-sword in Georgian times was always best taught by foreigners—first by Italians, and later by Frenchmen. Hence the fact that most of our fencing terms are but slightly-modified Italian or French words.

The *theory* of attack and defence may be summarised as follows:—

The first notion which it is necessary to grasp is the importance of "time," "measure," and "guard" (*tempo, misura, guardia; temps, mesure, and garde*).

An all-important principle in all fencing is to keep the proper "measure"—namely, to remain out of easy reach when on the defensive, and, conversely, never to attempt the delivery of an attack without being well inside striking distance. This law, which savours perhaps of a truism, is nevertheless one generally neglected by inexperienced or over-impetuous fencers. The next is to keep proper "time"—namely, in the first place, to reduce all motion of either body or weapon to the smallest necessary, both in point of number and in extent; in the second, to balance those motions carefully on the adversary's in order to remain always in position to seize at once every opportunity of offence or defence. The third is to keep proper "guard." A man is on "guard" when, holding his weapon in front of him, he is so placed that he can deliver every regular attack and come to every recognised parry with the minimum expenditure of energy.

The fencer on guard has four main attacks to choose from, and similarly four "openings" to defend. These are defined by reference to what are conventionally called "lines" (*linea; lignes*). An attack, for instance, delivered *above* the adversary's hand is said to come in a "high line;" below the hand, in a "low line;" to the right of the hand, in "outside line;" to the left, in "inside line."

Now every attack has its parry (*parata*, from *parare*, to protect; parade), just as every parry can be "deceived" or evaded by a "feint" (for it can never be too much repeated that there are no such things as "secret strokes" in swordsmanship). Four parries, so formed that the length of the defending weapon crosses the line of attack, are, strictly speaking, sufficient to meet all the requirements of defence. But in each of the four "lines" both attack and parry can be effected in two widely different positions of the hand—namely, either in *supination* (that is, with the nails turned upwards) or in *pronation* (nails turned downwards). Thus, there are actually eight natural ways of attacking and parrying sword (or any other "white arm") in hand—namely, two in each line, "carte" and "prime" (*quarta* and *prima*), in high-inside; "sixte" and "tierce" (*sesta* and *terza*), in high-outside; "septime" and "quinte" (*settima* and *quinta*), in low-inside; "second" and "octave," in low-outside. The terms used in England are the actual French words, derived from the older Italian schools. Carte, sixte, septime, and octave are in *supination*; the others in *pronation*.

The opponents on guard must, of course, be engaged in some definite manner with reference to "lines" and hand-position—that is, engaged in carte or tierce, or any other guard. (As a matter of fact, these two engagements, with that of *sixte*, are the most generally used.) The engagement covers, and naturally closes access to, one of the lines, but one only. To effect his purpose the attacking party must either seek another line or force an entry by "breaking the guard." This can

be done by "beating" or by "binding" the adverse blade; but the best mode is to "disengage" (by passing the point under the adversary's hand), or by "over-cutting" (passing the point over) so as to come from outside inside, or *vice-versa*, of the opponent's sword.

To meet attacks in a given line (other than that covered by the guard), the defending party must use a *parry* (the words guard and parry are not synonymous, as so many swordsmen seem to think)—that is, he must move his weapon so as to cross the new line. If the parry be made by thus passing from one guard to another, it is called "simple" or "opposition;" but if it be made so as to bring the adverse blade back to the original engagement, it becomes a "circular" or "counter" parry (*contro; contre*). There are, of course, as many simple and counter parries as there are attacks and guards—namely, eight, as above recited, two for each line.

It is naturally open to the attacker to "feint"—that is, to menace in one line with a view to obtaining an opportunity of delivering the stroke in another. Success in this attempt depends on precision and superiority in speed. The attack has to be delivered (if the opponent keeps his proper measure) by means of the "lunge" (*botta lunga; coup d'allonge*)—that is, by a step taken with the advanced foot, whilst the leg in rear is straightened. An attack thus put in, if parried, exposes the attacking party to the *repost* (*risposta*, an answer; riposte), which is a return attack dealt without lunging. The parry to be effective without an unnecessary expenditure of energy should bring the "fort" (the strong, the half nearer the hand) of the defender's weapon to bear upon the "foible" (the weak, the half nearer the point) of the attacker's blade; this, of course, secures the advantage of lever. Of the eight attacks and parries only six are really in general use—carte, tierce, seconde, sixte, and septime. Quinte and prime are more rarely resorted to.

Simple as these principles may appear, it has taken some three hundred years of practical fighting to bring about their universal recognition. They apply, as was stated above, equally to all cutting and thrusting weapons.

[For a complete history of the art, consult *Schools and Masters of Fence*, by Egerton Castle (Bohn's Artists' Library), and, for a practical treatise, select *The Swordsman*, by A. Hutton (Grevel and Co.).]

Fénelon, FRANÇOIS DE LA MOTHE (1651–1715), French prelate and author, was born in Perigord at the Château Fénelon. His uncle educated him at Cahors, and he was in youth of a gentle nature, a vivacious character, but a feeble constitution. He is said to have preached effectively at 15. He was sent to St. Sulpice at Paris, and took orders at 24, and became *curé* of St. Sulpice. He made his mark as the president of a female order, whose duty it was to teach Huguenot converts, and the king set him to the work of converting Huguenots—a post for which his persuasive eloquence made him eminently fitted. In 1681 he was made Prior of Carennac, and soon after published a *Traité de l'Éducation de Filles*, which made a great sensation.

In 1689 he was chosen to educate the king's grandsons—the Dukes of Burgundy, Anjou, and Berri—and he had great influence over the first of these, who, however, unfortunately died early. In 1694 he was made Archbishop of Cambrai. At this period of his life he had a theological controversy with Bossuet, and, falling beneath the displeasure of the Pope and of the king, was banished to his diocese. Here he published his celebrated *Télémaque*. The book caused some commotion, as Fénelon's enemies represented it as a libellous satire upon the king and court. His life and letters have been published, and in 1825 his *Œuvres Choisies*, with a biographical and critical notice, were published in six volumes at Paris.

Fenians. The original Fenians were mercenary troops in the service of the kings of Éire. They are said to have been composed of the tribes who were subjugated by the Scots in the first century of our era, and to have formed a regular standing army, consisting of three bodies, each modelled on the Roman legion, with which the Scots may have become acquainted during their inroads into Britain. They took their name from the hero Finn MacCumhail, who belonged to the Clan-na-Boiscné or Leinster body of Fenians. They were finally disbanded by the king of Éire, and entered the service of a rival king, but were nearly annihilated in the battle of Gabhra or Gavra (284 A.D.).

The modern society with this title, which aims at the subversion of British rule in Ireland, was founded in America, whither large numbers of Irish flocked after the famine of 1846–47. The association was composed of a "Senate," which held meetings at New York, and a number of "circles," each managed by its own "centre," which extended over the whole of the United States, and was especially active in Chicago and its neighbourhood. The "centres" were chiefly engaged in levying recruits, furnishing them with arms and training them in their use, and collecting funds for carrying out the revolutionary schemes determined on. The organisation gradually extended to Ireland, and parts of England with a large Irish population, and at last assumed such proportions that the British Government became alarmed. The Habeas Corpus Act was suspended in Ireland, additional troops were sent over, many of the leaders—including the "head-centre," James Stephens—were seized, and the chief organ of Fenianism, O'Donovan Rossa's *Irish People*, was suppressed. Some of those found guilty of treason were sentenced to penal servitude. The prompt action of the Government crushed sedition in Ireland for a time, but the escape of Stephens from prison revived the courage of his associates. His return to America, in company with other Fenians, was the signal for an abortive inroad into Canada (1866). In the spring of 1867 the struggle was renewed on British soil; an attempt was made to seize Chester Castle as the prelude to a general insurrection; it was unsuccessful, and several ill-organised risings in Ireland during the same year met with no better fortune. In the autumn of 1867 great excitement was caused in England by an attack on a police-van at

Manchester, resulting in the death of a constable, and by an attempt to blow up the wall of Clerkenwell gaol. In both cases the object was the release of prisoners suspected of Fenianism. In 1871 the United States Government received information of a projected raid into Canada in time to prevent its taking place. Among more recent movements of the Fenians we may notice the formation of a "Skirmishing Fund" (1883-85), the establishment of the Clan-na-Gael, and the murder of Lord Frederick Cavendish by a body of "Invincibles" in Phoenix Park, Dublin (1882).

Fennec (*Canis zerda*), a small North African fox, ranging into Asia, and remarkable for its large ears and its fondness for fruit rather than for



FENNEC.

animal food. [Fox.] Some authorities suppose that the reference in the Song of Solomon (ii. 25) is to animals of this species.

Fennel (*Feniculum*), a genus of umbelliferous plants, with compound umbels without involucre, yellow petals, and aromatic fruits. The common fennel (*F. vulgare*), a native of South Europe, now established on our coasts, reaches 4 feet in height, has its leaves cut into numerous linear segments, and from fifteen to twenty rays to its umbels. Roman Fennel, cultivated near Nismes, has from twenty-five to thirty rays, and produces curved fruits $\frac{1}{2}$ inch in length. Indian Fennel (*F. Panmorium*) produces shorter and straighter fruits. Oil of fennel and fennel water, used as stimulants and carminatives, especially for veterinary purposes, are distilled from them. They contain the stearoptene *anethol* or anise-camphor ($C_{15}H_{14}O$). Fennel leaves are used as a garnish to boiled fish.

Fenugreek (*Trigonella Fenum-græcum*), an erect annual leguminous plant about 2 feet high, probably a native of Asia, but cultivated for hay by the ancient Greeks and Romans, and still in Egypt and India. Its leaves consist of three leaflets, the terminal one stalked; the flowers are in axillary umbellate clusters; and the sickle-shaped pods contain ten to twenty seeds, from which 6 per cent. of a bitter oil can be obtained. The seeds are used in curry-powder, in cattle foods, and to improve the flavour of inferior hay. The whole

plant, and especially the seed, contains the aromatic principle *coumarin* ($C_9H_8O_2$), which also occurs in the Tonquin Bean, in sweet wood-ruff, in melilot, and in the sweet-scented vernal grass *Anthoxanthum odoratum*, giving the perfume known as "new-mown hay."

Fenwick, SIR JO'IN (1645-1697), an English conspirator, served for a time in the army, and in 1688 entered Parliament as a Tory member for Northumberland. He was accused as an accomplice in a plot to assassinate William III., and was committed to the Tower in 1696. He made statements involving the Whig leaders in the plot, and they brought in a bill of attainder against him, which was passed, and he was beheaded.

Feoffment, a form of transferring a freehold in land, whether it be a fee-simple, a fee tail, or an estate for life. [ESTATE.] It is not at the present time much in use, and it is effected by the person who is in possession (the feoffor) delivering up the possession to another (the feoffee), and expressing at the same time what estate in the land the feoffor intends that the feoffee shall have. Before the Statute of Frauds (29 Charles II., ch. 3) came into operation no writing was necessary to show for what purpose, or for what estate, possession was given of the land, but this statute requires a writing which is usually a deed. [DEED.] There is a copy of an ancient charter of feoffment in the appendix of vol. ii. of *Blackstone's Commentaries*. The giving up of possession is termed "livery of seizin," the word seizure indicating a freehold interest. [FREEHOLD.] The word feoffment is derived from feof, fief, feud. This livery of seizin may take place on the land when the feoffor and feoffee are both present there by the feoffor declaring his will to give up possession, and by the feoffee showing that he takes possession. It has been erroneously supposed that the delivery on the land by feoffor to feoffee of a clod of earth, or of a twig broken from the land, is a delivery of a symbol of possession. No symbol would satisfy the purpose, the feoffor must actually give up possession, and the feoffee must take possession, and the delivery of a clod of earth, or twig, are merely modes of showing the intention of the parties, and are not necessary. A feoffment may be made in view of the land if there be vacant possession, but the feoffee must take possession or he will not have got seizin. The writing must express the estate or interest which it is intended to convey to the feoffee; if no quantity of estate is expressed the feoffee acquires an estate for his life only. In order to convey the fee the word heirs must be used in the writing of feoffment. Livery of seizin may be made and taken by attorney. If land be on lease no livery can be made without the consent of the lessee or his representative in title, and who occupies the land. In gavelkind a feoffment may be made by any one of the age of 15 years. [GAVELKIND, FEUDAL SYSTEM.]

Feraga, an Arab tribe of Algeria, province of Oran, forming two groups: Feraga Thata (Lowlanders), and Feraga Fuaga (Highlanders). The

former occupy the plain comprised between the Sig and Habra rivers; the latter hold the slopes of the Sid-bu-ziri mountains skirting the same plain. Since 1866 both have been subject to French administration.

Ferah, three Barber tribes of Algeria: (1) *Beni-Ferah*, province of Algiers south-west of Cherchel, in the hills between Cheliff and the coast; (2) Uled-Ferah, same province, west of Aumaie, Dirah Mountains, about the head waters of the Isser and Wed-Sahel rivers; (3) province of Constantine, Aures mountains, 15 miles north of Biskra, and in a neighbouring oasis, where they cultivate the date-palm, fig, and olive, and raise crops of barley by artificial irrigation.

Ferdinand V. OF ARAGON (1453-1516), commonly known as Ferdinand the Catholic, a title conferred upon him by the Pope in reward for his expulsion of the Moors from Spain. He was an astute prince, and a profound, though crafty, politician; and his marriage in 1496 with the devout and enthusiastic Queen of Castile—Isabella—laid the foundation of Spain's greatness, though the joint action of the pair in establishing the Inquisition (1480), expelling the Jews (1492), and expelling the Moors (1501) was the primary cause of their country's decay. Cardinal Ximenes played no small part in the successes of the reign. The conquest of Granada, which took place in 1491 after ten years' war, the discovery of America for which Isabella furnished ships, and the acquisition of Naples (1503) and Navarre (1512) were the chief events of the reign. Two years after Isabella's death, which occurred in 1504, Ferdinand married again.

Ferdinand I. (1503-1564), Emperor-elect, was the brother of Charles V. Though he took the title immediately after his brother's abdication in 1556, it was not till two years later that he was acknowledged by the electors. In 1527 he became King of Hungary and Bohemia, which two countries thenceforward became part of the Hapsburg dominion. The Emperor was mild and an advocate of religious tolerance, and enforced the claims of his Protestant subjects at the Council of Trent. At a Diet held at Augsburg in 1559 he regulated the currency of the Empire, and redressed certain hardships which weighed upon his Protestant subjects.

Ferdinand II. (1578-1637), Emperor-elect, succeeded to the throne in 1619 upon the death of his uncle, Mathias. He was educated by the Jesuits, and was strongly opposed to Protestantism, and was most anxious to support all the decrees of the Council of Trent. This policy aroused the Bohemians, who declared the crown forfeited, and offered it to Frederick V., Elector-Palatine. Hence arose the Thirty Years' War. By the support of allies he was able to hold the throne, and his harsh measures drove many of his Protestant Bohemian subjects into exile.

Ferdinand III. (1608-1657), Emperor-elect, was the son of Ferdinand II., and succeeded his father. He had served in the Thirty Years' War, which, against his wishes, he was

obliged to continue till the Peace of Westphalia (1648). His reign was otherwise uneventful.

Ferdinand I., King of the Two Sicilies (FERDINAND V. of Naples) (1751-1825), was the son of Charles III. of Spain. When the father became King of Spain, the son succeeded him as King of Naples. His marriage with a daughter of Maria Theresa led to a close understanding with the Cabinets of Austria and Great Britain, and an opposition to the French after the Revolution, which led to three different humiliations of Ferdinand by the French. In 1814 the Congress of Vienna confirmed his title as King of the Two Sicilies, and in 1815 he was again established at Naples upon the flight of Murat, whom Napoleon had put upon the Neapolitan throne. In 1820 his disregard of an oath to observe a new constitution led to his further flight, but Austrian aid re-established him as a despot in 1821.

Ferdinand II. (1810-1859), commonly known as King Bomba (q.v.), King of the Two Sicilies, was the son of Francis I. and grandson of Ferdinand I. above-mentioned. He succeeded to the throne in 1830, and his despotic measures caused such additional discontent that his subjects revolted in 1848, and in that year he bombarded his capital. He made many promises of constitutional reform, but broke them on restoration to power, and in spite of the protests of Great Britain and France, who withdrew their ambassadors, he continued his despotic career, and filled his prisons with political prisoners. The storm came in his son's reign, when the crown of Naples and of the Two Sicilies became merged in that of Italy.

Ferdinand VII. (1784-1833), King of Spain. Being opposed to the policy of the chief minister of his father Charles IV., he was arrested as a conspirator, but a rising in 1808 forced his father to abdicate in the son's favour. In the same year he was forced to abdicate to Napoleon, who put Joseph Bonaparte on the throne, and kept Ferdinand in prison till 1813. After the downfall of Napoleon he returned to his throne, but his arbitrary rule caused continual outbreaks. By a Pragmatic Sanction of 1830 he abolished the Salic law, and left the crown to his daughter Isabella, excluding his brother, Don Carlos. [CARLISTS.]

Ferghana, a province of Russian Turkestan, in a valley at the head of the Jaxartes, and of importance at the present moment as bordering upon the region of the tributaries of the Oxus, in which Russia is extending her influence. It is in a range of the Thian-Shan mountains, and the only opening is at the west, where the river issues. The valley is an oval, 280 miles long by 140 miles wide, and contains over 28,000 square miles. It is on the road from Bokhara to Kashgar, and is very fertile in the south, and has fine mountain pastures. A new capital—Namangan—has taken the place of the old one—Khokand.

Ferguson, ADAM (1724-1816), a Scottish historian and political writer, was born in Scotland, and educated at Perth and St. Andrews, whence he

proceeded to Edinburgh to study for the ministry. He was for a time chaplain in the Black Watch, but, returning to Edinburgh after the peace of Aix-la-Chapelle, he became Keeper of the Advocates' Library in 1757. In 1759 he was appointed to the Professorship of Natural History, and in 1764 to that of Moral Philosophy. In 1774 he went with the Earl of Chesterfield on his travels. In 1778 he was secretary of a commission sent to America to try and arrange matters with the colonies. The next year he came back and resumed his duties until 1784, when he resigned, and spent the rest of his time in travel and retirement. Among his works are an *Essay on Civil Society*, *Institutes of Moral Philosophy*, a *History of the Roman Republic*, and two volumes of *Lectures*.

Ferguson, JAMES (1710-1776), an experimental philosopher, mechanic, and astronomer, born at Keith in Banffshire. As a boy he made a wooden clock, and, when employed upon a farm to keep sheep, he used to study the stars and measure their relative distances by a knotted string. Some wealthy neighbours encouraged his endeavours, and put him into the way of studying mathematics and drawing, and for some time he supported himself in Edinburgh by executing miniature portraits. In 1743 he came to London, where he published some astronomical tables and lectures, and the Prince of Wales settled a small pension upon him. In 1763 he became a F.R.S. He produced many works and papers, and was strong in astronomy and experimental physics, but was weak in mathematics.

Ferguson, PATRICK (1744-1780), was born in Aberdeenshire, and served in 1752 in the army operating in Germany. In 1776 he invented a breech-loading rifle. He was at the battle of Brandywine (1777), where he had an opportunity of killing Washington, but refrained. He died in South Carolina.

Ferguson, SIR SAMUEL (1810-1886), poet, scholar, and antiquary. He was educated at Trinity College, Dublin, and was called to the bar. He was President of the Royal Irish Academy and Deputy Keeper of the Records. In 1878 he was knighted. Among his works are several volumes of Celtic poems; in 1865 he published *Lays of the Western Gael*, and in 1883 *The Forging of the Anchor*; and he deciphered the Ogham Inscriptions.

Fergusson, ROBERT (1750-1774), a Scottish poet, was born at Edinburgh and educated at Edinburgh, Dundee, and at Edinburgh University and St. Andrews. First intending to enter the Church, he gave up this idea, and became a Writer to the Signet. He wrote poems both in pure English and in dialect, and was a good conversationalist. Excesses were partly the cause of his early death.

Ferishtah, a Persian writer, who was born near the Caspian Sea towards the end of the 16th century. At the age of 12 he went with his father, who was appointed tutor to an Indian prince, to India. In 1589 he began his valuable work, *A History of the Mohammedan Power in India*, the materials for which he showed much patience and

diligence in collecting. A good translation of this was published in London in 1829, as well as an earlier one at Bombay in 1881.

Fermanagh, an inland county of Ireland, in the province of Ulster, having an area of 714 square miles, and almost cut in two by Lough Erne. The county is generally undulating, with abrupt heights, but towards the west it is mountainous. The highest point, on the border of Cavan, is 2,188 feet. The soil varies, and is not remarkable for fertility. The farms are small, the chief productions being cattle, oats, flax, and potatoes. The county is well wooded, the principal trees being oak, ash, elm, beech, and fir. There is much limestone, and some coal and iron ore. Coarse linen is sparingly manufactured. Chief town, Enniskillen. The county returns two members. Pop. (1901), 65,430.

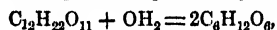
Fermat, PIERRE DE (1601-1665), a great French mathematician, was born near Montauban. Studies made in his youth with Pascal upon the properties of numbers led to his working out a calculation of probabilities. He also studied the theory of numbers, discovered a new way of squaring the parabola, and did much towards advancing geometrical science. He was also of considerable linguistic attainments, and had a controversy with Descartes upon geometry and optics.

Fermentation. The term fermentation (*fervere*, to boil), was originally applied to the alcoholic fermentation only, in which, owing to the production of gas, an effervescing liquid is obtained. Later the word was also used to denote many cases of effervescence to which it is no longer applied, and was extended to include phenomena of change or decomposition in various organic substances when exposed to air. These changes are generally due either to oxidation, or to the breaking down of complex molecules; but synthetic fermentations are also known as cases in which the principal products are reduction compounds. It was early recognised that a foreign substance, the *ferment*, was necessary to cause fermentation in most cases; but the nature of the ferments and of the process of fermentation was long unknown. At first the process was supposed to be due to purely physical causes, as in the theory advanced by Liebig. By the work of Schwann and Pasteur, however, it was shown that the *yeast*, the ferment necessary for the formation of alcohol, consisted of living organisms upon whose vitality the fermentation depended. Pasteur's further work showed that most ferments consisted similarly of organisms, usually bacteria or fungi, and that to each form of organism corresponded a particular fermentation. Some ferments, however, consist of unorganised compounds known as *enzymes*, which have not yet, however, been produced otherwise than through the activity of living matter. Since Pasteur's time much work has been done by many observers upon this subject, and though they tend to confirm Pasteur's views, no satisfactory theory of the action of ferments and the exact nature of the fermentative changes has been forthcoming. Most of the advances have been due to the use of pure cultivations of bacteria, by

which means the fermentation changes to be studied are not masked by subsidiary decompositions induced by other organisms. The preparation of such pure cultivations has therefore formed an important part of the work of chemists who devote their attention to this subject. [BACTERIA.]

In almost all cases a moderately high temperature and the presence of moisture are favourable to fermentation, which, in most cases, cannot proceed below 0° or above 100°. Certain substances, too, have the power of preventing fermentations where the ferments are organisms; as the various antiseptics used to prevent *putrefaction*. Among the more commonly known fermentations may be mentioned the *alcoholic* or *vinous*, *acetic acid*, *lactic acid*, and *nitric acid*.

Alcoholic fermentation of sugar, which plays such an important part in the preparation of so many beverages, has been known since very early times, and fermented liquids were known to the early Egyptians, etc. The decomposition was carefully examined by Lavoisier at the beginning of the 19th century, who showed the two main products of the reaction were alcohol and carbon dioxide. Very many organisms—chiefly microscopic fungi—can induce alcoholic fermentation, the form present in greatest quantity in the yeast usually employed being known as *Saccharomyces cerevisiae*. These are small round cells of about '0003 inch in diameter, which multiply very rapidly during the fermentation, which proceeds most rapidly at about 25° C. Cane-sugar is not directly fermentable, but is first converted into a mixture of dextrose and levulose, which then undergoes fermentation. The equation representing this change is



while the further change into alcohol and carbon dioxide is given by

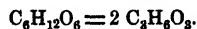


Besides these main products, *glycerine* (2·3 per cent.), *succinic acid* (6 per cent.), and a number of higher alcohols known collectively as *fusel oil* are also produced. These latter are probably due to the presence of other ferments.

Acetic acid is formed from alcohol in the presence of a fungus, *Mycoderma aceti* and of *Bacterium aceti*. The fermentation, which is essentially an oxidation, is utilised commercially for the manufacture of vinegar. Crude alcoholic liquors are mixed with a little vinegar, and exposed to air in large wooden tubs filled with beech shavings, the liquid collecting at the bottom being again passed through the tubs. To this fermentation, which proceeds best at about 30° C., is due the souring of alcoholic liquors when exposed to the air.

Lactic acid fermentation is a sugar decomposition which is induced in grape, cane, milk, and other sugars, when these sugars mixed with some albuminous material are exposed to air. The organism which effects the change is probably that known as *Penicillium glaucum*. To produce the fermentation putrid cheese and chalk are added to a strong solution of sugar, and the mass allowed to stand some days in a warm place (40° C.). The

chalk is necessary to neutralise the lactic acid when formed, as the fermentation does not proceed in an acid solution. The reaction is represented by the equation



If the action be allowed to proceed further the lactic acid itself is decomposed with the formation of *butyric acid*, and evolution of hydrogen and carbon dioxide.

Nitric and *nitrous* acids are obtained by the fermentative changes which ammoniacal salts undergo under the influence of organisms present in fertile soils. The process is known as *nitrification*, and the natural formation of nitre is due to this fermentation, which is very important in agriculture, as plants are unable to derive the necessary nitrogen from the ammoniacal salts themselves.

The unorganised ferments, *enzymes*, chiefly effect changes by causing an abstraction or addition of the elements of water with a simultaneous decomposition of the compound. In many cases their action can be imitated in the laboratory by the use of acids or alkalis. They play a most important part in digestion, many insoluble foods being rendered assimilable by their influence. They may be partially divided into:—(1) The sugar-forming, as the *ptyalin* of the saliva, *diastase*, *emulsin*, *invertin*, etc., which cause the decomposition of starch and other allied compounds into grape-sugar; (2) Those which cause the formation of *peptones*, as *pepsin* or *albumen*; and (3) *fat-decomposing* enzymes.

The changes which obtain in organic material and are known as *putrefaction* are also due to fermentation induced by a large variety of organisms. The subject has not been fully investigated, but much interest is attached to the formation in most cases of a number of poisonous basic substances known as *ptomaines*, many of which have within recent years been isolated and examined by Brieger and other chemists.

Fernando Po, a West African island, situated in the Bight of Biafra, 20 miles from the mainland, in lat. 3° 12' to 3° 47' N. and long. 8° 26' to 8° 57' E., being oblong in form, 35 miles long, and 22 miles wide in the south, its broadest part. A ridge of mountains, running from N. to S., passes through two-thirds of the length of the island, its highest point being in the north, where Clarence Peak reaches a height of 11,000 feet. The island is well provided with harbours, the largest being Maidstone Bay, on the N.E., with Clarence Town on the creek that leads out of it. This was originally an English settlement, made by permission of Spain, and afterwards abandoned. The island is beautifully wooded, the chief trees being the palm and the notable silk-cotton tree. The fine native race seems peculiar to the island. The island was first settled by the Portuguese, and was ceded in 1778 to Spain, which now owns it.

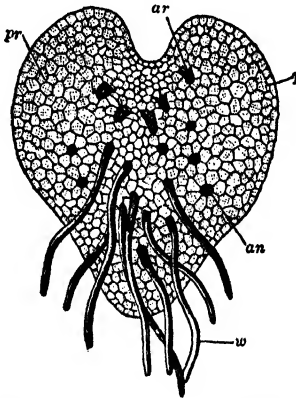
Ferns, a popular term for certain groups of Pteridophyta, or vascular Cryptogamia, the precise limits of which have not as yet been generally agreed upon. The club-mosses (q.v.), or Lycopodiaceae, and Equisetaceae [EQUISETUM] are sometimes



FERNS

1. MAIDENHAIR (*Adiantum Capillus-Veneris*). 2. *Asplenium Hemionitis*. 3. PARSLEY FERN (*Allosorus crispus*).
 4. YOUNG PLANTS OF FLOWERING FERN (First Year). 5. HARD FERN (*Blechnum spicant*). 6. *Asplenium fontanum*.

termed "fern-allies;" but the tropical Marattiaceæ, which have the habit of ordinary ferns, and the less similar Ophioglossaceæ, the adders'-tongues and



THE GAMETOPHYTE OR PROTHALLIUM OF THE SHIELD FERN (*Aspidium*), magnified.

ar, Archegonium; an, antheridium; w, root-hair; pr, prothallium.

moon-worts, both of which groups differ from ordinary ferns in the mode of origin of their sporangia, are popularly known as ferns. On the other hand, this name has not been usually applied to the Rhizocarpeæ (q.v.) or Hydropteridæ, such as the pill-wort (*Pilularia*), which are now classed as heterosporous ferns. [FILICINEÆ.]

Ferns commonly exhibit a marked alternation of generations (q.v.), their life-history consisting of a small and transient oophore, gametophyte, or prothallium, and of the more familiar sporophore, or fern-plant. Apogamy (q.v.), in which the sporophore results from the vegetative growth of the prothallium, without sexuality, occurs normally in some species; but the correlative apospory (q.v.), in which prothallia, or rudimentary sexual organs, spring directly from the frond, without the formation of spores, has been chiefly observed in cases of abnormality. The spore, which is unicellular, and sometimes contains chlorophyll, on germinating gives rise to a small plate-like prothallium, generally heart-shaped, composed of one layer of green cells giving off numerous root-hairs, and bearing the antheridia and archegonia on its under surface. The antheridium is a small papilla, the central cells of which each produce an antherozoid. This consists of a flat band of protoplasm coiled spirally three or four times, with numerous cilia towards its apex, and its mother-cell, containing a few starch-grains, loosely adherent to its broader end. The outer cells of the antheridium absorb water when it is mature and burst it, liberating the antherozoids. The archegonia are less numerous than the antheridia, and are flask-shaped; but, unlike those of mosses, their "venter," or swollen portion, is sunk in the prothallium, and their "neck" consists only of four to six tiers of four cells each. The canal-cells in the neck become mucilaginous, and are partly expelled, the mucilage capturing the antherozoids, which

then penetrate to the central cell, or oosphere, and fertilise it. The now fertilised oospore acquires a cell-wall and forms an embryo, dividing into cotyledons, of which the upper four form stem and cotyledon, the lower four, radicle and "foot," by which food is temporarily drawn from the prothallium.

The sporophyte, or mature fern, is generally perennial, but varies in size from minute herbaceous "filmy ferns," an inch in height, with fronds only one cell thick, to the arborescent "tree-ferns" of the tropics, which may exceed 80 feet in height. The stem may be creeping and subterranean, as in the common bracken (*Pteris*), or may climb, as in *Lygodium*, with long internodes, or it may be erect and cylindric, as in the tree-ferns. It has a single apical cell; its cortex is often thickened, and bands of sclerenchymatous dark-coloured tissue give it strength. The "vascular" bundles in the larger stems form a regular cylinder of a network of anastomosing bands, each with a central xylem rarely containing true vessels, but mainly composed of scalariform tracheides, and with true sieve-tubes in the phloem.

The roots are usually numerous, and may completely cover the base of the stem, each root having a root-cap. The leaves or "fronds" are invariably stalked, and present a more varied range of form than those of any other group of plants, being simple in the hart's-tongue (*Scolopendrium*), and many times pinnate in others, and varying in size from an inch to 10 or 20 feet. The veins in the leaves are generally *furcate*, bifurcating repeatedly, and not as a rule meeting again; and the *circinate* vernation, or rolling up of the leaflets and leaves from their points, is very characteristic. Several species freely produce adventitious buds and plantlets on their fronds, as in *Asplenium viviparum*, *A. bulbiferum*, and *A. proliferum*. Though not as a rule, there is sometimes a marked difference between the "fertile," or spore-bearing, fronds and the "barren" ones, the former having less cellular tissue, as in the hard fern (*Lomaria spicata*) and the elk's-horn (*Platyserium*). The sporangia are generally on the under surface of the frond, and are variously grouped. In the so-called "flowering ferns," such as *Osmunda*, they are only produced on the upper part of the frond, where the cellular tissue is undeveloped. On the stems and leaf-stalks of ferns brown multicellular hairs and plate-like chaffy scales, or *paleæ*, frequently occur.



THE SPORANGIA, OR UNDER SIDE OF PINNULE OF SHIELD FERN (*Aspidium*), showing the sori covered with discoid indusia.

The sporangia, of spore-cases, are of the nature of trichomes, or modified hairs, each originating from one epidermal cell (*leptosporangiate*), and consisting of a stalked capsule with walls one cell thick. A ring or group of thick-walled cells

(annulus) generally crosses it, and by its elasticity bursts the sporangium and liberates the spores. The sporangia are generally grouped together in rounded or linear clusters known as *sori*, each sorus being sometimes covered by a membranous outgrowth from the epidermis, the *indusium*, or by the inrolled margin of the frond. Ferns are *isoporous*, having only one kind of spore.

There are six chief orders:—(i) **POLYPODIACEÆ**, with an incomplete vertical or marginal annulus, the largest order, including *Adiantum*, *Pteris*, *Lomaria*, *Asplenium*, *Scolecopendrium*, *Aspidium*, *Lastrea*, *Polypodium*, *Platyserium*, *Ceterach*, *Dicksonia*, and *Davallia*; (ii) **CYATHACEÆ**, with a complete oblique annulus, including most tree-ferns, such as *Cyathea* and *Alsophila*; (iii) **GLEICHENIACEÆ**, with a broad complete transverse annulus and naked sori, as in *Gleichenia*; (iv) **HYMENOPHYLLACEÆ**, the filmy ferns, with marginal sori in cup-shaped indusia, including *Hymenophyllum* and *Trichomanes*; (v) **OSMUNDACEÆ**, with unsymmetrical sporangia having obliquely apical groups of annulus cells, including *Osmunda* and *Todea*; (vi) **SCHIZÆACEÆ**, with ovoid sessile sporangia having apical annuli, including *Ancimnia*, *Schizaea*, and *Lygodium*.

Ferns are distributed over the whole globe, from the equator to the arctic zones, abounding in moist warm climates and, therefore, in insular floras. In the tropics many are epiphytes, and most tree-ferns belong to the same region. Fossil ferns occur in the Old Red Sandstone, abundantly in the Coal-measures, and in more modern rocks. Few species have any economic value, the paleæ of some being used to stuff cushions, and the male fern, *Nephrodium Filix-mas*, as a vermifuge; but their beauty, and the ease with which they can be cultivated, render the whole group favourites in our gardens. There are some 3,000 known species.

Ferrar, NICHOLAS (1592-1637), a religious enthusiast, was educated at Clare Hall, Cambridge, of which society he became fellow in 1610. He then studied medicine for five years upon the Continent, and afterwards set up as a merchant in London. In 1624 he was returned to Parliament, and the next year he established a religious

community at Little Gidding in Huntingdonshire, taking deacon's orders in 1626. The little community of 30 was made up of himself, his brother, his brother-in-law, and their families. Their work of bookbinding was combined with many services and much prayer. Charles I. visited them in 1633, and again in 1642. The fellowship was broken up by the Puritans. An account of the community will be found in *John Inglesant*.

Ferrara, formerly a lordship and later a duchy of Romagna in Italy. The House of Este held it as a Papal fief till 1597. After many changes of fortune and condition, the greater part of it reverted to the Papal throne in 1814, and in 1860 it passed to the King of Italy, and now forms the province of Ferrara. Its capital, of the same name, is a well-built town, enclosed by a wall, 7 miles round, on a fertile plain near the Po, but it has fallen into decay. It is an archbishopric, and the cathedral and churches contain some interesting paintings and sculptures. There are a public gallery of paintings, a school of medicine and of jurisprudence, and a large public library. Here Ariosto was educated, and spent his latter years; and a cell is still shown where Tasso was imprisoned. There are tanneries and silk and glass works.

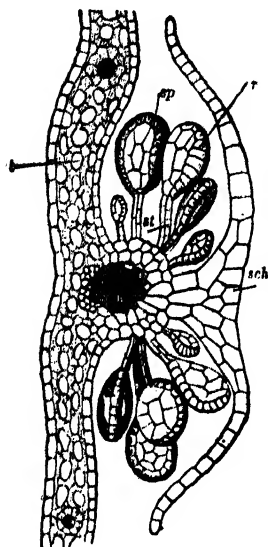
Ferrara, ANDREA (16th century), was born at Belluno in North Italy. He, with his brother, was renowned for the forging of sword blades, which had a European reputation. Some think that the brothers were Spaniards, others that they were Italians originally from Ferrara; and they are said to have had the secret of tempering blades from Damascus.

Ferrari, GAUDENZIO (1484-1549), a painter of the Milan school, who studied under Giovannone. In 1504 he went to Florence, and came under the influence of Raffaello. In 1524 he was appointed to execute a fresco of the *Crucifixion* in the Chapel of Sacro Monte at Varallo in Piedmont, some of the figures of which are modelled in relief. He painted many subjects, most if not all sacred. His *Glory of the Angels* is at Saronno, near Milan.

Ferrari, PAOLO (1822-1879), an Italian dramatist, born at Modena. His first comedy was produced in 1847. His style is sparkling, and much resembles a French style. *Goldeni* was produced in 1852. In 1860 he was made Professor of History at Modena and in the Academy of Milan. His works have been collected into fourteen volumes.

Ferrates, salts of "ferrie" acid, H_2FeO_4 , which has not at present been isolated. The potassium, barium, and a few other salts have, however, been prepared.

Ferret (*Putorius furo*), a domesticated albino variety of the polecat (*P. fustidus*), bred in Europe and America for killing rats and driving rabbits from their burrows. It is about 14 inches long exclusive of the tail, with yellowish-white fur and characteristic pink eyes, and invariably breeds true except when mated with the wild form, when the young partake of the characters of both parents. The variety probably arose in southern Europe or



MAGNIFIED SECTION THROUGH PART OF FROND AND SORI OF SHIELD-FERN (*Aspidium*).
b, Mesophyll of leaf; sp, sporangia; st, stalk; r, annulus; sch, indusium.

Africa in classic times, when the polecat or the marten was kept as a mouser. When used to drive rabbits from their burrows, ferrets are muzzled or held in a leash; without this precaution they would probably gorge themselves with blood, and sleep till thirst compelled them to come out. They are also employed to kill fowls for the table, which they do very neatly with a single bite. Ferrets can never be called "tame," and show no affection for their masters, who, however, handle them fearlessly and are rarely bitten. But these animals never lose their thirst for blood, and there are instances on record of their attacking children in the cradle with terrible effects.

Ferric Salts are salts of iron corresponding to ferric oxide (Fe_2O_3). When anhydrous they are usually colourless, but are of a yellow or brown colour when combined with water. The most important salt is *ferric chloride* FeCl_3 , which forms iron-black crystals, very deliquescent, dissolving to a brown liquid. Ferric salts may be readily distinguished by giving in solution a fine blue precipitate with potassium ferrocyanide and a blood-red coloration, even in dilute solutions, with ammonium sulphocyanate.

Ferricyanides, Ferrocyanides, the salts respectively of *hydro-ferricyanic acid* $\text{H}_3\text{Fe}(\text{CN})_6$ and *hydro-ferrocyanic acid* $\text{H}_4\text{Fe}(\text{CN})_6$. Although the acids themselves are unimportant and rather unstable, many of the salts are important compounds. Potassium ferrocyanide $\text{K}_4\text{Fe}(\text{CN})_6$ is known commercially as *yellow prussiate of potash*. It is obtained by heating crude potash, iron filings, and animal matter—such as leather, horn, dried blood, etc., in large iron pots. The mass is extracted with water, and the yellow prussiate purified by recrystallisation. It forms large yellow monoclinic crystals, which are not poisonous. It is largely used in chemistry, as it is the source from which almost all the *cyanogen* compounds are derived. It is also used as a test for ferric compounds, yielding with these salts in solution a blue precipitate—Prussian blue. Potassium ferricyanide $\text{K}_3\text{Fe}(\text{CN})_6$ is known as *red prussiate of potash*, and is manufactured by passing chlorine through a solution of the yellow prussiate $\text{K}_4\text{Fe}(\text{CN})_6 + \text{Cl} = \text{K}_3\text{Fe}(\text{CN})_6 + \text{KCl}$. It forms dark red, easily soluble crystals. It is a powerful oxidiser, and is of frequent use in the chemical laboratory and in photography. With solutions of ferrous salts it gives a blue precipitate closely resembling Prussian-blue and Turnbull's blue, probably ferrous ferriocyanide, $\text{Fe}_2\text{Fe}(\text{CN})_{12}$.

Ferrier, DAVID, physician, was born at Aberdeen in 1843, and educated at the university there, where he graduated in 1863. He then studied at Heidelberg and at Edinburgh. He was afterwards appointed Professor and Physician at King's College, London, and became F.R.S. in 1876. His speciality is the brain and epilepsy, and he employs vivisection. In 1876 he published *Functions of the Brain*, and in 1878 *Localisation of Cerebral Disease*, and is the editor of *Brain*.

Ferrier, JAMES FREDERICK (1808–1864), a Scottish metaphysician, was born at Edinburgh,

and was educated at Edinburgh and Oxford, and was called to the Scottish bar in 1832. He abandoned law for literature, and contributed to *Blackwood's Magazine*. These contributions showed him to be a man of mark, and in 1845 he was elected Professor of Moral Philosophy at St. Andrews. His best-known work is the *Institutes of Metaphysic*, and his lectures on Greek philosophy were published two years after his death.

Ferrier, SUSAN (1782–1854), a Scottish novelist, was born at Edinburgh, where she spent the greater part of her life, her father having been a Clerk of Session along with Sir Walter Scott. She often visited Abbotsford, and was a great favourite of Scott. Her three novels, *Marriage* (1818), *Inheritance* (1824), and *Destiny* (1831), besides showing great humour and power of arranging plot and incident, are of great value as representing the habits and manners of the Scottish upper middle class while it was still Scottish.

Ferrol, a Spanish town on the N. side of a bay in the province of Corunna, and 12 miles N.E. of the town of Corunna. The bay is entered by a narrow and well-fortified channel, and forms a magnificent harbour. There is a fine arsenal, and swords, cutlery, and military and naval equipments are largely manufactured. The chief imports are steel, yarn, silken and woollen goods, timber, and colonial produce; the chief exports are agricultural produce.

Ferrottype, a photographic process used for the formation of a positive picture without the previous formation of a negative. [PHOTOGRAPHY.] The process is carried out in the following manner: A thin sheet of blackened iron is coated with an even layer of "iodised" collodion—i.e. collodion containing some iodide and bromide of silver in solution. It is then immersed in a solution of silver nitrate, and is ready for exposure in the camera. The image is usually developed by a solution of ferrous sulphate, and in those parts where the light has acted a deposit of silver of a white or grey colour is produced. The shadows are represented by the black iron showing through the collodion. The plate is fixed by a solution of potassium cyanide, which dissolves away the unaltered silver salts. The process is one very largely used by itinerant and sea-beach photographers, as the photographs, though not usually of high artistic merit, can be taken, developed, dried, and completed in a few minutes.

Ferrous Salts, iron salts corresponding to ferrous oxide FeO , as, e.g. *ferrous sulphate* FeSO_4 (known commercially as *copperas*). They are usually colourless when anhydrous, but when combined with water are usually green or blue. They rapidly oxidise when exposed to air, forming ferric salts. They are recognised in solution by giving a fine blue precipitate with potassium ferricyanide.

Ferry (from A.-S. *faran*, to go), a passage by boat over water. Foot-passengers are usually conveyed in rowing-boats, horses and carriages in flat-bottomed barges, with a sloping surface at one end to facilitate landing. The barges are either rowed

or drawn over the river by means of a rope, which passes over pulleys or through rings fixed to the barge. The ferryman propels the barge by pulling the rope. If the distance be great, steam-ferries are now commonly used.

A *flying-bridge* is a kind of ferry-boat used in military operations. The boat is attached by a rope to a buoy in the middle of the river, and steered in an oblique direction, so that, owing to the force of the current meeting its side, it tends to take a course at right angles to its length. Meanwhile the rope draws it towards the buoy, the result of the combined forces being that it moves with the buoy as centre, and so passes over the river.

Ferry, JULES FRANÇOIS, a French statesman, was born in the Vosges in 1832. He was called to the Paris bar in 1854, and in politics opposed the Court party. He wrote in the *Temps*, where appeared his *Comptes Fantastiques d'Hausmann*. In 1869 he was a member of the Corps Législatif, and voted against the war. During the siege of Paris he was a member of the Government of National Defence, and in 1872 he was appointed Minister to the Court of Athens. In 1879 as Minister of Public Instruction he was instrumental in the expulsion of the Jesuits; and he was Prime Minister in 1880-81, and again in 1883-85. It was he who established the French protectorate in Tunis in 1881; and in his second Ministry the war in Madagascar and Tonquin led to the fall of his Cabinet and his own retirement from public life. In 1893 he returned to favour and was elected President of the Senate, but he died after holding the office for a few weeks only.

Fertilisation, a term commonly applied in botany to the processes by which the pollen of flowering-plants is conveyed to the stigma. These are preferably termed pollination (q.v.), the term fertilisation being restricted to those processes which more immediately precede and accompany the union of the two reproductive cells in true or sexual reproduction. Among flowering plants these processes may be delayed for hours, or even for months, after pollination. In their simplest condition the sexual cells seem not to differ from cells capable of asexual reproduction. In *Ulothrix*, for instance, one of the lower algæ (Conferoidæ), small ciliated protoplasmic bodies are produced (micro-zoospores), which may either germinate directly, or may unite in pairs fusing into a *zygospore*, which grows into a new plant. This union of similar sexual bodies is termed *conjugation*, and the bodies so uniting are called *gametes*—*planogametes* when ciliated, *aplanogametes* when not so. In somewhat higher groups of algæ the gametes lose all power of direct germination without conjugation, thus becoming purely sexual: they differ in size, the female being the larger; and the female is not ciliate, or loses its cilia at an early stage. This female gamete is then termed an *oosphere*; the unicellular organ producing it, the *oogonium*; the male gametes, *antherozoids*; the organ producing these, generally in large numbers, the *antheridium*; the fusion of these gametes, *fertilisation*; and its product, an *oospore*. Among

the Conjugatæ, cells from two filaments lying side by side put out protuberances, which meet and become confluent. In *Mesocarpus* their nucleated protoplasmic contents contract, pass into the connecting tube and coalesce into a *zygospore*. In *Spirogyra* the contracted contents of one (male) cell pass right over into the other cell, so that the *zygospore* is formed there. In the Floridæ, which are the most highly organised algæ, the antherozoids having no cilia are termed *spermatia*, and the female organ, or *carpogonium*, is sometimes multicellular and terminates above in a tube known as the *trichogyne*. The spermatia are carried by water to this trichogyne, their contents enter it, and numerous *carpospores* originate by cell-division within the *carpogonium*.

Among fungi conjugation of planogametes, like those of *Ulothrix*, occurs among the Chytridiaceæ, and conditions like those of *Mesocarpus* in the common mould *Mucor*. In the higher moulds, the Peronosporæ and Saprolegniæ, the antheridium or *pollinodium* puts out a tube which pierces the oogonium and protoplasm from the former enters the latter and coalesces with the oosphere. The higher Ascomycetes, including nearly all lichens (q.v.), resemble the Floridæ in having spermatia, carpogonia, and sometimes trichogynes, and fertilisation results in the growth of a more or less complex fructification containing carpospores or *ascospores*, so-called because produced eight together in club-shaped *asci*. Among both algæ and fungi occur lowly forms without sexual reproduction, and higher forms in which the reproductive organs are functionless, and reproduction is apogamous.

Mosses, ferns and their allies, and gymnosperms are united under the name Archegoniata, because they have their single oosphere within a multicellular receptacle, or *archegonium*, which opens above, and gives entrance in the first two classes to ciliated antherozoids. In gymnosperms, and still more among angiosperms, the archegonium is reduced, and the male organ is the *pollen-tube*, the protoplasm of which does not break up into antherozoids. In the microspore or pollen-grain of flowering plants the protoplasm divides into two cells, the *vegetative* and the *reproductive*. Among gymnosperms the former divides into several *included cells* with distinct walls; but among angiosperms this is not so, and the nuclei of both cells commonly pass down into the pollen-tube when it is protruded, the reproductive nucleus undergoing division. In angiosperms the pollen-tube grows from the stigma, where the pollen-grain adheres, down the stylar canal into the ovary and into the micropyle of an ovule, where it may have to pierce some perispermic tissue before reaching the embryo-sac (megaspore); but in gymnosperms the pollen-grain is carried directly into the micropyle at the bottom of which it slowly protrudes its tube through some thickness of tissue before reaching the *neck, rosette, or stigmatic cells of the corpuscula*, or archegonia at the apex of the embryo-sac. Among angiosperms these are represented only by the *egg-apparatus* of three cells, the oosphere and two *synergidae*, at the apex of the embryo-sac. The wall of the embryo-sac is absorbed, and apparently

part of the protoplasm of the pollen-tube, with one or more reproductive nuclei, passes through its mucilaginous wall. A second nucleus (the *male pronucleus*), which no doubt is this generative nucleus, now appears in the oosphere and coalesces with its nucleus (the *female pronucleus*). In some cases one of the synergidæ appears to play a part analogous to that of a trichogyne. The fertilised oosphere acquires a cell-wall, and by division gives rise to the suspensor and embryo. In most Floridæ and Ascomycetes, as a result of fertilisation, adjacent cells grow up round the carpogonium forming a "fruit" or *cystocarp*; and among Phanerogams, not only do the *carpels* or *female sporophylls* enlarge around the fertilised seed, but in some cases other floral leaves and axial structures become modified so as to contribute to the *fruit*. [FLOWER, FRUIT, POLLINATION, SEX.]

Fescennine Verses, a kind of jeering verse dialogue, usually in the Saturnian metre, carried on by the country folk of ancient Italy at their harvest celebrations and other festive gatherings. They are believed to have taken their name from Fescennium, a city of Etruria.

Fesch, JOSEPH (1763-1839), Cardinal and Archbishop of Lyons, was Napoleon's maternal uncle. He was commissary of war to the Army of the Alps under General Montesquieu after the Revolution, and again to his nephew's Italian army in 1796. In 1801 he returned to his ecclesiastical condition, and in 1802 became Archbishop, and the next year Cardinal and French ambassador to the Papal Court. His ultramontane views displeased the Emperor, who sent him to a kind of exile at Lyons. In 1814 he went to Rome, and after the Hundred Days, during which he returned to France, he again retired to Rome. He refused to resign his episcopal rights till forced to do so by the Pope, and he finally died at Rome.

Festivals. The religious feasts of savage races are connected with ancestor worship, and among the civilised nations of antiquity there still existed some festivals of this primitive character, but the worship of nature early prevailed both among the Semites and Aryans. The changes of the seasons brought to mind the personified forces supposed to control them, and a regular succession of ceremonial observances became established from year to year. Even where—as among the ancient Greeks—nature-worship degenerated into mere polytheism, the character of the festivals pointed to the origin of the gods in whose honour they were held. The tendency is innate in human nature, for, on the discovery of the New World, the same worship was found to exist among the Peruvians and Mexicans. The latter had a remarkably full calendar, with many movable and immovable feasts. Among the races of the Old World the ancient Persians alone possessed a form of worship entirely void of religious symbolism.

In Homer there are a few scanty allusions to festivals marking the progress of the year; in the Homeric hymns and Hesiod the number is greatly

increased, so that a fuller ritual must have grown up in the intervening period. By the age of Pericles it had reached its full development, and the number of days on which all public business, including the administration of justice, was suspended, amounted to about a sixth part of the entire year. Among the more famous Greek festivals may be mentioned the two *Panathenæa*, in honour of Athene, the four *Dionysia* in honour of Bacchus, and the Eleusinian mysteries. Of a different character were the great national meetings at the Olympic, Pythian, Isthmian, and Nemean games, when the religious gathering was made an occasion for literary, artistic, and, above all, athletic contests.

The Roman calendar recognised a division of the year for religious purposes into *dies festi* and *dies profesti*. The former were *feriæ* or public holidays, on which the festivals of the gods were held, public business was suspended, and slaves enjoyed an intermission of their toil. They were of three kinds, according as to whether they were held annually on a fixed day, observed every year at a varying time selected by the priests or magistrates, or enjoined in consequence of some exceptional circumstance. The first class included some of the principal Roman feasts. Among the oldest of these were the *Lupercalia*, in honour of Lupercus, god of fertility, the *Palilia*, in honour of Pales, god of shepherds, and the *Saturnalia* or festival of Saturnus, which eventually extended over seven days in December. Some festivals were called *ludi* in consequence of the "games," such as theatrical representations, chariot-races, and gladiatorial combats, which accompanied them. Of the festivals, the days of which might be changed, the most important was the *Feriæ Latina*, originally an assembly of the whole Latin nation on the Alban Mount, but afterwards converted into a Roman holiday. As the consuls could not take the field before they had held the *Latina*, the magistrates who had charge of the festival could hasten or retard public business by choosing an early or late date for its celebration. It was part of the Roman policy to adopt the gods of conquered nations, so that the number of festivals greatly increased during the later years of the Republic. Among late introductions were the *Megalesia*, the festival of the Phrygian goddess Cybele, who was first worshipped at Rome in 203 B.C., and the *Ludi Apollinæres*, or "games of Apollo," established in 213 B.C.

The festivals of the Hebrews differed widely from those of other ancient races, since they were all directed to the worship of one Supreme Being. They fall into three classes—the Sabbath and the festivals connected with it in idea; the great annual festivals of the Passover, Pentecost, and Tabernacles; and the Day of Atonement. The first class comprised the Feast of Trumpets on the first day of the seventh month, the Sabbath (or seventh) Year, when the land was left untilled and its produce belonged to the poor, and the Year of Jubilee, celebrated at intervals of seven times seven years, when land which had changed hands was restored to the family of its original owner, and all slaves of Hebrew descent were set free. The three

great festivals — especially those of Pentecost, Wheat harvest (or First Fruits), and Tabernacles (or Ingathering) were closely connected with agriculture, as is shown by their names and the offerings by which they were accompanied. They also commemorated great historical events, but this was probably a new feature introduced by Moses. The influence of the mystic number 7 in the arrangement of the whole Hebrew calendar is very remarkable. After the return from Babylon two new festivals were added—those of Purim and Dedication.

Among the Christians of the apostolic age there were no sacred days except the Sabbath, which was henceforward celebrated on the first day of the week. For a long time, however, Saturday as well as Sunday was observed in places where Jewish influence predominated. It was not till the latter part of the 2nd century that the *Pascha Staurosimon* (corresponding to Good Friday) and the *Pascha Anastasimon* (Easter), which took the place of the Passover, were recognised throughout the Christian Church. In the same way the Jewish Pentecost soon afterwards became the Christian Whitsunday. During the 4th century Epiphany and Christmas Day were added to the list, and the observance of Ascension Day seems to have become general at about the same time. From this time onwards there was a growing tendency to increase the number of festivals. Days were set apart for the worship of the Blessed Virgin, and others were consecrated to apostles, saints, and martyrs. The change was doubtless due in part to a desire to attract pagans accustomed to the gorgeous ceremonial of heathen temples; but it was highly detrimental to the purity of the Christian religion, while the enforced cessation of work and the character of the festivities carried on in churches (which often pandered to the lowest tastes of the populace) exercised a pernicious influence both on public life and private morality.

At present there is a separate office for each of the numerous festivals of the Roman Catholic Church. The number observed by the Greek Church is even larger, as several patriarchs and prophets find a place in their calendar.

The chief Mohammedan festivals are the 'Eed-el-Kabeer (great festival) and the 'Eed-el-Shagheer (minor festival), which follows the fasts in the month Ramâdan. Others commemorate the birth of the prophet, his ascension into heaven, and similar events.

Festus, **SEXTUS POMPEIUS** (probably about 800 A.D.), a Roman grammarian, who wrote a kind of Latin dictionary—an abridgment of one by Verrius Flaccus—which is valuable for the light it throws upon Latin etymology. Only one MS. of his work is known to exist. A good edition was produced at Göttingen in 1839 by K. O. Müller.

Fetoh, a wraith, a double (q.v.).

Fetichism, the belief in or doctrine of fetiches. The term *fetich* (from the Portuguese *feitico* = magic) was introduced by de Brosse (q.v.) in the 18th century, to describe what were supposed to

be the gods of some of the peoples of West Africa, and afterwards it was used as a substantive. Professor Waitz says that the negro believes that "a spirit dwells, or can dwell, in every sensible object, and often a very great and mighty one in an insignificant thing. This spirit he does not consider as bound fast and unchangeably to the corporeal thing it dwells in, but that it has its usual or principal abode therein. The negro, indeed, in his conception, not uncommonly separates the spirit from the sensible object which it inhabits; he even sometimes contrasts the one with the other; but most usually combines the two to form a whole, and this whole is (as Europeans call it) the 'fetich,' the object of his religious worship." The native name is *grigri*, or *jugu*, and the use of the word "fetich" is confined to Europeans. The objects in which a spirit is supposed by the natives to dwell are classed by Tylor as "rubbishy trifles:" "stones, claws, bones, a pot with red earth and a cock's feather stuck in it, pegs wound over with yarn, red parrots' feathers, men's hair, and so forth." The possession of a fetich is thought to give its owner power over the spirit inhabiting it; and Sir John Lubbock defines fetichism as "that stage of religious thought in which man supposes he can force the deities to comply with his desires." The negro worships his fetich, and pours copious libations of rum over it, as long as he supposes that it brings him good fortune; but when it ceases to do this he will discard it for something else which he thinks more powerful.

Fétis, **FRANÇOIS JOSEPH** (1784-1871), a Belgian composer, was born at Mons, and educated at the Paris Conservatoire, where, after being for some time organist at Douai, he was professor from 1818 till 1833. In that year he was appointed Director of the Brussels Conservatoire. He has written, besides his operas, sacred music, violin pieces, etc., a treatise on *Fugue and Counterpoint*, a *Universal Biography of Musicians*, a *Manual for Directors of Orchestra and Military Bandmasters*, and a treatise on the *Theory and Practice of Harmony*.

Fetzara, a mixed Arabo-Berber tribe, province of Constantine, Algeria; in the hills of the Seybouse basin, south-east of Guelma. Originally the Fetzara were pure Arabs of the Ghatafân family, who formerly roamed the steppes of Cyrenaica, passing thence through Tunisia to Algeria, where they became amalgamated with the surrounding Berber populations. They give their name to the large lake or salt lagoon of Fetzara, which is supposed to have been formed by underground disturbances since their arrival in the country.

Feu, or **FEW**, a free and gratuitous right to lands made in consideration of services to be performed according to the proper nature thereof. Feu in Scots law means vassal tenure, as against wardholding or military tenure, being that holding where the vassal, instead of military service, gives a return in money, which is termed the feu duty or feu annual. In Scotland building land is usually granted on feu not on lease, so that the owner granting land for building has not, as in England,

a reversion, but grants the land in perpetuity in consideration of a perpetual annual rent-charge or payment. [FEUDAL SYSTEM.]

Feudal System, Feuds, Feudalism.

The *Feudal System* may be described as a tenure of land founded upon Feuds which were introduced under the new dynasties founded by the barbarous tribes who during the 4th, 5th, and 6th centuries poured themselves from Germany and neighbouring countries into the Roman Empire. In every province which they subjugated, large tracts of territory were divided by lot among the conquerors, some portion falling to the king or general of the invading tribe, and the rest to his soldiers, who received their shares as free and independent property, subject only to the condition of bearing arms, as occasion might require, in the defence of the community from hostile aggression. Of the lands assigned to the sovereign of the tribe, certain portions were afterwards distributed by him among his adherents, and chiefly his courtiers or companions (*comites*), but the interest they derived under these grants was not strictly in the nature of property. It was of a beneficial or usufructuary kind only, a mere stipendiary return for services (usually of a military character) which they were expected to render to their master, and subject at some future period to resumption, the *proprietas* or actual ownership of the land being still considered as vested in the sovereign himself.

Some time elapsed after the feudal relation began to be known to Europe, before the right of inheritable succession was fully conceded. In its primitive state the possession was held at pleasure, or for a short term only; afterwards the tenure was for life, the lord resuming the land on the death of the tenant, and granting it out afresh. But at length the son of the tenant was permitted to succeed—an indulgence which was followed by the extension of the grant, first to the tenant and his issue (*i.e.* in fee tail) and finally to him and his heirs (*i.e.* in fee simple), the law marking out a course of descent, which enlarging by degrees, embraced his relations, lineal and collateral, male and female.

So long as the vassal's interest was either precarious or of a very limited duration, the property in the soil continued in the lord, whose condition was that of a landowner, while the vassal was a mere occupier. But the vassal on acquiring the right to hold the land for life, rose in estimation, and when at length he came to receive the pure and proper feudal donation to him and his heirs in perpetuity which left nothing in the lord but the chance of resumption on the failure of heirs, or the violation of some condition expressed or implied in the grant, the original proprietary right was exchanged for seigniorial honours, and both lord and vassal grew in dignity. A grant without words of succession was limited to the life of the grantee only—of such antiquity and so linked with history was the well-known rule which till recently required the express mention of heirs in order to convey the fee by deed. But an estate less than for life ceased, as we shall presently see,

to be of any consideration as regards the feudal compact.

The tenant who under a grant to him and his heirs had acquired a permanent interest was competent to carve out various interests of less extent called in law particular estates—as (passing by holdings determinable at will) an interest to continue for any given number of years, or any other definite period of time, or for the life of the grantee or of another person; or for the life of the grantee with a capacity of transmission to his lineal heirs, male or female, or both (*i.e.* an estate tail). We recognise in these derivative interests the successive modifications which the tenancy underwent before it attained the hereditary estate, and which were initiated by the vassal, secure in the full possession of the fief. He did not stop there, but pursuing the precedent to its final result, even affected seigniorial rank.

Such is a brief sketch of the origin and establishment of the Feudal System, which bound together by a community of interest and duties the whole proprietary body. So strong, indeed, was that principle that it imposed upon the sovereign himself a legal necessity that all the landed possessions enjoyed by subjects of the realm should be holden either mediately or immediately of him. The system was not so much an invention of government applied systematically to the management of conquered countries, as a conventional arrangement of property, established by gradual usage and brought into general adoption by its tendency to protect persons of inferior rank from the inconvenience of civil disorder. At the same time it also tended to aggrandise the more powerful lords, and it also operated to maintain an effective force to repel hostile invaders.

The feud was conferred by words of gratuitous and pure donation, *dedi et concessi*, which would still be the operative words in a modern infeudation or deed of feoffment in the English law. [FEOFFMENT.]

This donation was perfected by the ceremony of corporal investiture, or open and notorious delivery of possession in the presence of the other vassals, which delivery perpetuated among them the era of the new acquisition, at a time when the art of writing was very little known, and therefore the evidence of property was reposed in the memory of the neighbourhood, who in case of a disputed title were afterwards called upon to decide the difference, not only according to external proofs adduced by the litigant parties, but also by the internal testimony of their own private knowledge.

Besides an oath of fealty or profession of faith to the lord, which is the parent of our oath of allegiance, the vassal or tenant, upon investiture, usually did homage to his lord.

Besides the fealty and homage, the relation of lord and vassal was ordinarily attended with the following feudal incidents:—(1) Aid; (2) Relief; (3) Fine on Alienation; (4) Escheat and Forfeiture. [See those Titles.]

The fabric of the Feudal System in England was shattered by the storm of the Civil War. The restoration of the king could not restore what had

thus been in practice swept away. By the statute 12 Charles II. c. 24, all tenures of any honours, manors, lands, tenements or hereditaments, or any estate of inheritance at the Common Law held either of the king or of any other person or persons bodies politic or corporate, were turned into free and common socage to all intents and purposes. It was not till after the lapse of nearly another century that the tenures and other institutions of feudalism were put an end to in Scotland by the statutes passed after the rebellion in the 20th year of the reign of George II.

Some of the consequences of tenures as they at present exist cannot be better exemplified than by the rules as to the forfeiture and escheat of lands, both of which have, however, undergone many modifications since the statute of Charles above referred to.

Feuerbach, LUDWIG ANDREAS (1804-1872), a German philosopher, born in Bavaria. He studied divinity in Heidelberg, but being smitten with a love of philosophy he went to Berlin, where he attended Hegel's lectures. For a time he seemed to have adopted Hegel's principles, but he gradually worked himself free of them and took up an independent position. He supported himself by acting as a private tutor, but his publication of *Thoughts on Death and Immortality* (1830) disgusted the Government by its negation of personal immortality, and he was deprived of his position as *privat-docent*. He then married a lady possessed of some little property, and for some time lived a retired country life in the castle of Bruckberg. In after years he suffered a good deal both in body and estate. He may be looked on as representing the reaction from metaphysics to empiricism, and though he has had some influence upon German thought, made little impression outside his own country. Among his chief works are a *History of Modern Philosophy*, *The Essence of Christianity* (1841), and *Theogony* (1857).

Feuerbach, PAUL JOHANN ANSELM VON (1775-1833), a German jurist, especially in the department of Criminal Law, was born at Jena, where his education began, to be continued later at Frankfort. At the age of 17 he entered the University of Jena, and after devoting himself for a time to philosophy he abandoned this for jurisprudence. He took his doctor's degree in philosophy in 1795, and in law in 1799. In this year he began to lecture at Jena, having already, in 1796, published a *Critique of Natural Law*. He then produced several works upon the theory of punishments and crimes. In 1802 he was appointed a professor at Kiel, and undertook the task of drawing up a criminal code for Bavaria, which was adopted in 1813, and became the base of several other codes. In 1817 he was nominated second president of one appeal court and first president of another. He interested himself much in Kaspar Hauser. Among his works are *Remarkable Criminal Trials* (2 vols.), and *Contributions to the Art of Law-making*. His son wrote a biography of him (1852).

Feuillet, OCTAVE, a French novelist, was born at St. Lô, in the department of La Manche. He aided Dumas in literary work, and his first independent work was *Le Fruit Défendu* in *La Nouvelle Revue*. His *Scènes et Proverbes* and *Scènes et Comédies* represent about seven years' work, starting from 1848. In 1862 he was made an Academician, in which year he published *Sybille*, having already written in 1858 *Le Roman d'un Jeune Homme Pauvre*, which to the thinking of many is his best work, though others prefer the tender sentimentality of *Sybille*, which is a pretty picture of the old rural patrician life. To a pleasant style and delicate touch, Feuillet adds the qualities of delicacy and decency, though his tendency to sentimentality prevents his taking a very high place in the first rank of novelists. He wrote several other novels and comedies.

Feuilleton, the part of a political journal devoted to general literature, usually divided from the newspaper proper by a horizontal line. It originated in France, being first adopted by the *Journal des Débats* at the beginning of the 19th century. It often consists of criticisms on art or literature, and many famous French novels made their first appearance in this form.

Fever, or PYREXIA, a diseased condition of the body characterised by undue elevation of temperature. The normal temperature of the body averages about 98·6° Fahrenheit, and although it undergoes slight variations according to the time of day, the ingestion of food, the amount of exercise taken, etc., these variations are confined within narrow limits, a very close equilibrium being maintained between the amount of heat produced by the oxidation of food taken into the body and the amount of heat lost by the lungs and skin and in the various excreta. In fever the temperature is raised above the normal; this appears to be in the main due to an increased production of heat by disintegration of the tissues, rather than to a diminution in the loss of heat from the body. If the temperature is raised only two or three degrees, the fever is said to be slight; if the thermometer indicates an increase to 103° or 104°, the fever is said to be high; while if the temperature exceeds that amount the condition is said to be one of *hyper-pyrexia*. Certain symptoms are usually associated with elevation of the body temperature. The fever is generally ushered in by shivering attacks or *rigors*; the skin is hot and dry; the pulse and respiratory movements are quickened; headache is common; vomiting may occur; the tongue is dry and coated; and the urine scanty and high-coloured. The termination of a febrile attack may be either by crisis or lysis. In the former case the temperature suddenly falls to the normal, in the latter the diminution of temperature takes place more gradually. The term *intermittent* fever is applied to those cases where there are several rises of temperature separated by intervals in which the normal temperature is registered. In *remittent* fever the temperature remains throughout the attack above the normal, but the degree

of elevation undergoes diminution or remission from time to time. In *continued* fever the elevation of temperature is fairly continuously maintained throughout the attack. *Hectic* fever is a fever of remittent or intermittent type, which continues for a long period of time and is associated with loss of flesh, sweating, and flushing of the cheeks; the term is especially applied to the fever which develops in the course of tubercular disease of the lungs and joints. Fever should be regarded as the name for the group of symptoms already described rather than as a disease in itself. It is not possible to do more than to refer briefly to the forms of disease in which fever occurs. They may be divided into two groups; in the first place, there are the specific febrile diseases (malaria, smallpox, typhus, typhoid, scarlatina, measles, etc.), and secondly there are all those maladies in which inflammation affects some part or organ of the body (pneumonia, pleurisy, abscess, etc., etc.).

Fez, a town in Morocco, of which it became part in 1548, and is now the second capital. It is situated about 100 miles E. of the Atlantic, and 80 S. of the Mediterranean, in an oval valley through which flows the "River of Pearls," dividing the town into the Old Town on the right bank, and the New Town on the left. The town is in a cultivated district, and presents a striking appearance from a distance, being surrounded with strong walls, which, however, are now falling into decay. There are many ruins of all kinds in the neighbourhood, and the hills to the S. are covered with groves of orange, olive, and other trees. The streets are narrow and dirty, and present blank walls to the passer-by, the windows and openings generally being towards the courts and gardens. The houses are lofty, and on a level with the first floor are roofs of reed or the like, the result being that the sun never penetrates into the streets, and the people have the reputation of being the palest of all Moors. Once Fez was a great seat of learning, but it is no longer so. There are two principal mosques, one of which has a court for women worshippers, and the other is a refuge for criminals. There are good gardens round the palace. The town is a depôt for the Barbary trade, and many caravans pass through it. The manufacture of fezzes were once a speciality, it being thought that the peculiar shade could not be manufactured elsewhere. This dye comes from a berry grown in the neighbourhood, and is used also in the preparation of morocco leather, much of which comes from Fez. The town was founded in 793 by Prince Edris, and became the capital of the Mahometan states of West Africa, and a very sacred city, which was often the object of pilgrimages. The Moors when expelled from Spain brought here their arts and manufactures. Though very hot in summer the climate is pleasant in winter. A road from Tangier (160 miles) is practicable for horses and camels. The population consists of Berbers, Arabs, negroes, and Jews, the last managing to thrive in spite of the persecutions to which they are subjected.

Fezzan, a country of the Sahara belonging to Turkey, and in the government of Tripoli. It extends for 390 miles from N. to S., and 420 from E. to W., and lies between lat. 30° 40' to 24° 10' N. and long. 10° 30' to 18° 20' W., and contains 156,000 square miles. It is crossed about lat. 28° N. by the Black Mountains, which are a volcanic mass in a plateau of white limestone, and reach a height of 2,982 feet. A peculiar feature are the shallow Trona lakes, which produce a kind of brine shrimp, which when made into paste much resembles red-herring in taste. The climate is, for the most part, regular, though it is at times very hot, and in winter the cold is at times considerable. But the country is dry and healthy, and there is next to no rain—a matter, however, of little importance, as plenty of water is to be obtained at a slight depth for irrigation and other purposes, and the roots of the large trees, such as the palm, penetrate to the water-bearing strata. Although there are five harvests a year, and plenty of fruit might be grown, the cultivation of the soil is a good deal neglected. The date is the chief food of the people, and of the animals, of which there are few besides the camel, fowls, pigeons, a few horses and sheep, and here and there an antelope. Views vary much as to the amount of population. The trade of the district is small. The jurisdiction is vested in a lieutenant-governor.

Fezzāni, the inhabitants of Fezzan, North Africa, between Tripoli and Lake Chad. They are variously estimated at from 50,000 to 200,000, sedentary in the oases, nomad in the intervening steppes. The latter are mainly Arabs belonging to the three great tribal groups of the *Riāh* in the central districts between Sokna and Hartū; the Hotmān and the Megārha in the western district about the Wady esh-Shiātī and on the stony Hamādas. West of Murzuk are the Kel-Tinālkūm Tuaregs (Berbers) and other Tuareg clans in the south-west, while the northern tribes, such as the Guntarār of the Wady Sofejin, the Ulād Bu-Sef, and the Urfilla are also Berbers more or less Arabised. The Ghariān and Nefūsa hills in the extreme north are still almost exclusively peopled by Berbers, though several nearly pure Arab tribes occupy the steppes between the Great Hamāda and the Ghariān hills. Of the settled populations of the oases the substratum is certainly Negroid, a mixture of Sūdānese negroes (Kanuri, Kanembu, Hausda, etc.) and Saharan Hamites (Tibbu of Tibesti and Tuaregs). They are of a somewhat repulsive type, very dark, with high cheek-bones, broad nostrils, small eyes, large mouth, broad, flat features, crisp or kinky hair. The dominant language is Arabic, though Kanuri and Hausda are also widely spoken owing to the constant stream of slaves arriving from Bornu, Sokoto, and other parts of Central Sūdān. The independent Hamite tribes all speak either various Berber dialects or Teda, that is, Northern Tibbu as current in the Tibesti uplands. (H. Barth, *Travels*, 1857; H. Duveyrier, *Exploration du Sahara*, 1864; Gerhard Rohlfs, *Quer durch Afrika*, 1874; Nachtigal, *Von Tripolis nach Fezzan*, 1878.)

Fiasco, literally a failure in a musical performance; hence, a breakdown of any kind. In Italy, when a singer makes a false note, the audience shout "*Olà, olà, fiasco*." The allusion may be to the bursting of a bottle (*fiasco*, Eng. flask).

Fiber. [MUSQUASH.]

Fibres, thin threads of various origin vegetable, animal, or mineral. Fibrous substances are mainly employed for four classes of purposes—for weaving into fabrics or textiles, as they are termed, for cordage, for paper-making, and for brooms and brushes. Asbestos (q.v.) is the only natural fibrous mineral substance of any economic importance. Fine metallic wires, though sometimes woven, are not usually considered as fibres commercially. Fibres of animal origin are few in number but of great economic importance. Silk (q.v.), the cocoon of various species of silkworm, and wool (q.v.), the fleece of the sheep, are the most important; but mohair (q.v.), Cashmere wool, and other forms of goat's-hair and alpaca (q.v.) are also extensively employed as textiles; horse-hair is both woven and used for stuffing; and the hair of the grey squirrel, the badger, the bear, the skunk, and the cow's ears are used for "camel-hair brushes," shaving-brushes, and gilder's brushes, as are hog's bristles for harder kinds of brushes. These animal fibres, being all albuminoid, burn with the smell familiar in burning feathers; but wool and hair contain sulphur, which silk does not. They all dissolve if boiled in a ten per cent. solution of soda, which vegetable fibres do not. Vegetable fibres are structurally of three classes, unicellular hairs on seeds, bast-fibres of Dicotyledons and fibro-vascular bundles of Monocotyledons. Cotton (q.v.) is the only member of the first class important as a textile, various so-called silk-cottons and vegetable-silks being used only for stuffing cushions, etc. The members of this class being unaltered and unthickened cellulose (q.v.) have less strength than the lignified members of the other two classes. Of the second class the most important are flax (q.v.), hemp (q.v.), jute (q.v.), and China-grass, reed or ramie (*Boehmeria*) as textiles; sunn-hemp (*Crotalaria*) for cordage; the baobab (q.v.) for paper; and lime-tree and Cuba bast (q.v.) for mats and gardeners' purposes. Alfa (q.v.) or esparto grass, though a monocotyledon, is used whole, like flax, but is exclusively a paper material, not being, as are many other fibres, employed first as a textile and then worked up into paper from rags. Wood fibre, derived from aspen and other poplars, alder, spruce, and pine, which is now employed in increasingly large quantities as a paper material, though dicotyledonous, can hardly be classed here, since the whole tree, even leaves as well as wood and bark, and not the bast only, is used. Of the third class the chief are the New Zealand flax (q.v.) from the leaves of *Phormium tenax*; Manila hemp (q.v.) from those of *Musa textilis*; Sisal hemp and pita, from those of species of *Agave* (q.v.); pineapple fibre, from those of the pine-apple (*Ananas sativus*); coir (q.v.), from the fruit of the coconut palm; and the "ramenta" at the base of the leaves of the Kitul, Piassaba, and Gomuti palms,

which, under the name of "vegetable bristles," are now largely used for brooms, brushes, cables, etc. Brush-grass, or chien-dent, the wiry rhizomes of the South European grass *Chrysopogon Gryllus*, and broom-corn or brush, the dried fruit-stalks of the various species of *Sorghum* (q.v.) grown for their grain in the United States, especially by the Shaker communities, are also important as material for brooms. Besides these, many other fibres are employed locally for these purposes, for stuffing cushions, for cordage, or even for native textile manufactures. Though the inexhaustible wood-supply of the world may provide for the paper-manufacture, or for all but the very best, constant search is made for new fibres that in length, strength, fineness, elasticity, and colourlessness are suitable for woven fabrics in the first place, and subsequently to make rags valuable for the best paper.

Fibrin is a substance which is formed during the coagulation of blood. It does not exist ready-made in the living, circulating blood, but in certain diseased conditions, and when the blood is shed, fibrin formation occurs, and to the peculiar physical properties of the substance the phenomena of coagulation are in the main due. Fibrin is composed of a meshwork of fine white, highly-elastic fibrils which entangle and enclose the red blood corpuscles. Shortly after the appearance of the fibrils, they contract and squeeze out the fluid portions of the coagulated mass, which thus becomes obviously divisible into two parts: the solid *clot*, and the expressed fluid or *serum*. Fibrin may be obtained, freed from red corpuscles, by whipping recently shed blood with a bundle of twigs. The fibrin adheres to the twigs and can thus be separated in a nearly pure state. It is found to be a body allied in chemical composition to the group of substances known as Proteids (q.v.). The causes of its development in shed blood, and the reasons why fibrin formation should not occur in the circulating fluid, are but ill understood. [Blood.]

Fibrospongiae, the group of the sponges including those in which the skeleton is not calcareous. As in other sponges (q.v.), the skeleton consists of a series of spicules; in this group the spicules are either siliceous or of the soft fibrous material known as spongin: the latter series include the common sponges of commerce, and the former the siliceous sponges, which are typically of deep-sea habitat. There are four divisions, the *Hexactinellidae* (q.v.), the *Tetractinellidae* (q.v.), the *Monactinellidae* (q.v.), and the *Keratosas*. [Sponge.]

Fibula, the long slender bone situated on the outer side of the leg, its head or upper extremity articulates with the tibia, but does not enter into the formation of the knee-joint, its lower extremity articulates with the astragalus, one of the bones of the ankle.

Fichte, JOHANN GOTTLIEB (1762-1814), a German philosopher, was born in Lusatza. He was

educated at a Saxon royal school, and studied at Jena, Leipzig, and Wittenberg, and then spent some time as a *privat-docent*, enjoying meantime the society of Kant. At Königsberg in 1792 he published an *Essay of Criticism of all Revelation*, and this procured him a Professorship of Philosophy at Jena. In 1800 appeared his *Theory of Science*, which was founded upon Kant. Being suspected of atheistical views on account of an article he wrote in his *Philosophical Journal*, he resigned his professorship, and went into private life at Berlin, in which city, after the close of the war between Prussia and France, he was appointed Professor of Philosophy (1810). In 1813, when the war with France had begun again, Fichte's wife aided in nursing the sick and wounded French and Prussians in the hospitals, and caught hospital fever, of which she died; and Fichte, who had nursed her, likewise caught it and died. In philosophy he is the offspring of Kant, but he completes the idealistic development which Kant himself rejected. He divided things into the thinking (absolute) ego, and the non-ego created by the thinking ego, a perfect idealism; while in practical ethics he both taught and practised virtue, integrity, and self-denial. His *Closed Commercial State*, a protest against all foreign trade, is an unintentional *reductio ad absurdum* of Protectionist views. He gave a great stimulus to German patriotism. Many of his works have been translated into English, and his son published his biography and literary correspondence.

Fichtelgebirge, a mountain group of Bavaria, forming the centre from which extends the Erzgebirge in the N.E., the Frankenwald in the N.W., and the Böhmerwald in the S.E., determining the course of the Eger E., and the Saale N. to the Elbe; the Main W. to the Rhine, and the Naab W. to the Danube. Its chief heights are the Schneeberg (3,490 feet) and the Ochskopf (3,340 feet). The country is thickly populated and well wooded; and among the productions are iron, copper, vitriol, sulphur, lead, marble; and mother-of-pearl is obtained from the streams. Iron-mines, forges, blast-furnaces, and charcoal-burning provide occupation for the people. A watering-place called Alexandersbad is coming into vogue as a pleasure and health resort.

Ficino, MARSILIO (1433-1499), an Italian philosopher and ecclesiastic born at Florence. His early talent came to the notice of Cosmo de Medici, to whom Ficino's father was physician. Cosmo had the boy educated, and set him to translate *Plato and the New Platonists* into Latin, and to aid himself in founding a Platonic Academy later. Ficino considered Platonism, which he did not always distinguish from Neo-Platonism, as at one with Christianity, and was somewhat given to mystic views and interpretations. He entered the Church in later life, and was made rector of two churches and canon of the cathedral of Florence. His chief work is *Theologia Platonica: de immortalitate animarum ac æternâ felicitate*. In this he advocates the immortality of the soul.

Fictions in English law have abounded, and they have been somewhat cynically defined as "those things that have no real essence in themselves, but are acknowledged and accepted in law for some especial purpose." These especial purposes are various. The law (by which must be understood those who, for the time being, are the expounders and interpreters of it), it is said, shall never make any fiction but for necessity and in avoidance of a mischief (Coke's *Reps.* vols. iii.-xxx.). This is equivalent to saying that those who interpret the law will, in order, to avoid a special hardship, or remove some unexpected difficulty not provided for by the law, resort to a fiction—that is, they will assume something to be which is not. It has been remarked that these fictions have always a good result in view, a result, that is, considered good by those who make or maintain the fictions. Fictions of law must not be of a state of things impossible, but the reason for this is somewhat curious, "for the law unites nature." Under this head there is a canon of law, "that a man shall never be subject to the penalty of a statute by a fiction." The following are a few of many instances. The old action of Ejectment was founded upon a fiction, the names of the nominal Plaintiff and Defendant being purely fictitious [EJECTMENT]; the levying of a fine as a mode of conveyance of real estate, now abolished [FINE]; the action in which a father recovers damages for the seduction of his daughter is to the present day founded upon the "loss of her services." Many fictions, so far from being injurious, have often been beneficial, but their existence indicates a defect which it is the business of legislation to remedy, and many of them have been remedied during the present and preceding reigns.

Field, in *Physics*, signifies any portion of space through which stress is transmitted. A book in the middle of a room possesses weight—that is, gravitational stress is transmitted mutually between the book and the earth. The space between is therefore part of the field of gravitation. A piece of iron brought near the poles of a magnet is acted on by a definite force; the iron is thus in a magnetic field. A field must evidently possess a medium for the transmission of the stress, either gravitational, magnetic, electric, or other. This medium must exist even when all ordinary matter is absent. It is called the *ether*, and its properties are being gradually discovered by studying the nature of the stress, and of its transmission. [ETHER.]

Field, CYRUS WEST, was born in Massachusetts in 1819. After starting a prosperous paper factory, he took up the idea of having an Atlantic telegraph cable, and having obtained a concession for fifty years from the Government of Newfoundland, he (with others) founded in 1854 the New York, Newfoundland, and London Telegraph Company, and the Atlantic Company in 1856. He worked hard to arouse interest in the enterprise on both sides of the Atlantic, and the first cable was laid in 1858. This, however, was soon broken, and then the

Civil War caused a temporary cessation of operations. But in 1866 final success attended his efforts, and he received a gold medal and the thanks of the nation. He also interested himself greatly in the New York elevated railway. He died in 1892.

Field, DAVID DUDLEY, an American jurist, brother of the above, was born in 1805, in Connecticut. He was the first President of the Association for the Reform of the Law of Nations, and for the substitution of the principle of arbitration in place of war. He did much towards reforming the judicial system. In 1857 he produced a political and civil code, which was either partially or entirely adopted by several states. He was instrumental in the formation of the Committee of the British Social Science Congress for the consideration of an International Code, which committee presented its report in 1873. He died in 1894.

Fieldfare (*Turdus pilaris*), or Grey Thrush, a native of Northern Europe, visiting Britain and the southern parts of the Continent and western Asia in winter. It is about 10 inches long, general upper surface deep chestnut, with the head and neck bluish-grey; the breast is reddish-yellow, streaked and spotted with black, the rest of the under-surface white. The fieldfare feeds on molluscs and worms, and, failing these, on haws and other berries and seeds. The eggs are five or six in number, light-blue mottled with brown or black, but these birds rarely breed in Britain.

Field Glass is a special form of telescope adapted for such purposes as the observation of races or the inspection of distant views. It closely resembles the ordinary opera-glass, but the latter is designed for shorter distances. The field-glass is usually binocular, consisting of two Galilean telescopes (q.v.) arranged side by side. Such glasses give erect images, whereas ordinary telescopes give inverted images. A screw-nut placed between the two tubes enables the observer to adjust the distance between object-glass and eyepiece so as to suit his particular sight.

Field Magnet, in *Magnetism*, is a special magnet placed suitably in a given mechanism so that its field of force may be utilised to control the motions of other magnets, to generate motion in armatures through which electric currents are passed, or to generate electric currents through armatures that are set in motion in the given field of force. The first function is performed in several electrical measuring instruments, the second in electric motors, and the third in dynamos. The design of a field-magnet depends on the qualities required of its field of force. For this field to be very intense—i.e. for the action on a small magnetic pole to be very great at any part of the field—the magnet should be built of soft iron, and should be excited by being covered with coils of wire round which a powerful electric current is flowing. The two ends or poles should be brought as near as possible together, the field of force being then confined practically to the space between the pole-pieces. Special shaping of these pieces will

render the field locally intense, or will produce general uniformity in its intensity. [GALVANOMETER, MAGNETISM.]

Field Marshal, the highest rank of officer in the British, German, and other armies. The first English field-marshal was John, Duke of Argyle, and George, Earl of Orkney, who received the title in 1736. It was abolished in France in 1848, and has never existed in the United States.

Field Mouse, a popular name for *Mus sylvaticus* [MOUSE], but loosely applied also to *Arvicola agrestis* and *Sorex vulgaris*. [SHREW, VOLE.]

Field Officer, an officer above the rank of captain, but below that of general. The three grades of field-officers—colonels, lieutenant-colonels, and majors—are all mounted, and, in the infantry, command regiments, battalions, and semi-battalions respectively.

Fielding, ANTONY VANDYKE COPLEY (1787–1855), a noted English painter in water-colours. He began to exhibit in 1810 at the Society of Water Colours, and at the Royal Academy in 1811; but most of his works were sent to the water-colour exhibitions, and he became successively a member, secretary, treasurer, and (from 1831) president of the Royal Society of Water Colour Painters. For some time he lived in Sussex, and some of his most successful pictures were views taken in the South Downs. He also painted well storms at sea and British lake and mountain scenery, and also painted a few pictures in oil.

Fielding, HENRY (1707–1754), a distinguished English novelist, was born at Sharpham Park, in Somerset, his father being a general and his mother the daughter of a judge. He was connected with the Fieldings, Earls of Denbigh, and was thus a cousin of Lady Mary Wortley Montagu. He was educated first by a curate in his own neighbourhood, who is said to have sat for the portrait of Parson Trulliber, and then went to Eton. About this time some love troubles seem to have befallen him, and we next find him studying law at Leyden. He seems also at this period to have been in straitened circumstances, for although he had an allowance from his father it was seldom paid, and the son's habits were careless and extravagant. Upon his return to London he devoted himself to play-writing, and his *Love in Several Masques* was produced in 1728, to be followed by the *Temple Beau* in 1730, to be followed later by the *Modern Husband*, a play of a type that did not find favour with the play-going public. From Molière he adapted the *Mock Doctor* and the *Miser*. He made, however, a great success with burlesques, of which *Tom Thumb* (1730) and *Don Quixote in England* were well received. About this time he married a lady who is commonly thought to be the model from which he drew his Sophia Western. Shortly afterwards, some of his satire displeased Sir Robert Walpole, who introduced a bill into Parliament providing that all plays should be licensed by the Lord Chamberlain. This put an end to Fielding's theatrical career, and he turned his attention to

law, entering at the Middle Temple in 1737, and being called to the bar in 1740, when he joined the Western Circuit. In this year Richardson's *Pamela* appeared, and Fielding, in ridicule of its sentimentality, published, in 1742, his *Joseph Andrews*, where the *roles* of the principal characters are reversed. This has lately been dramatised by Mr. Buchanan as *Joseph's Sweetheart*. About this period of his life Fielding had many difficulties, and was well befriended by Lyttelton, the Duke of Bedford, a Mr. Allen, who is thought to be the original of Parson Adams or Squire Allworthy, and others. In 1747 he made a second marriage, and in the following year was appointed Justice of the Peace for Westminster, holding his sittings at Bow Street. This position, though not of as much importance as at the present day, gave him considerable influence, and he appears to have discharged its duties with zeal and integrity, and to have made efforts in the direction of legal reform. He was, later, appointed chairman of quarter-sessions. His masterpiece, *Tom Jones*, was published in 1749, and has been translated into many languages, and dramatised both abroad and at home, where Mr. Buchanan produced it under the title of *Sophia*. Coleridge speaks of its fresh, breezy nature. In 1751 appeared *Amelia*, a character for which he has been supposed to have drawn upon his second wife, and the book was read with pleasure by Johnson, who did not, however, abstain from calling its author "block-head" and "barren rascal." In all, Fielding wrote twenty-four plays, and many pamphlets, etc., while he both contributed to and conducted newspapers at different times of his life. In later years his ill-health compelled him to take a voyage to Lisbon, where he died; and in the journal of this voyage Walpole is spoken of in terms which show that the ancient grudge between them had disappeared. *Tom Jones* and *Joseph Andrews* have long been considered as classics, although their style does not suit them to general reading according to the tastes of the present day.

Fieri Facias, a judicial writ of execution issued on a judgment obtained in an action in the Courts of Justice. It is directed to the sheriff of the county in which the goods and chattels of the person against whom the judgment is given are situate, and is called a Writ of "Fieri Facias," from the words in it whereby the sheriff is commanded "*quod fieri facias de bonis*," etc. (that he cause to be made of the goods and chattels of such person the debt or sum required). From this writ neither peers nor any other privileged persons are exempt, and it lies also against executors and administrators with regard to the goods of their deceased. The sheriff may not break open any outer door to execute the writ, but must enter peaceably; and he may then break open any inner door in order to take the goods. He cannot execute the writ on a Sunday, or within the precincts of a royal residence. But he may sell the goods and chattels of the party against whom the writ is issued, including even his estate for years (which is a chattel real) or his growing crops (which are in the nature of personalty), till he has raised enough to satisfy the

judgment. This, however, is subject to certain restrictions, which the law has deemed it reasonable to impose for the protection of landlords; for, first by 8 Anne, c. 18, the sheriff cannot lawfully sell goods lying upon any premises demised to a tenant, unless the landlord be first paid his rent accrued due before the execution, to the extent of one year's arrears (in case of a weekly tenancy only four weeks' arrears), and, secondly, by 56 George III., c. 50, no sheriff shall carry off, or sell for the purpose of being carried off the premises, any straw, hay, manure, or the like from any lands let to farm in any case where by the covenants or agreements in the lease the carrying off the same is prohibited as between landlord and tenant, but such produce may nevertheless be lawfully sold to any person who will agree in writing to use and expend the same upon the lands according to the tenants' obligation, and lastly by 14 and 15 Victoria, c. 25, sec. 2, if growing crops are seized and sold on a fieri facias or other writ of execution by the sheriff, they shall still, so long as they remain on the lands (and where there is no other sufficient distress), be liable to be distrained for rent becoming due from the tenant after such seizure and sale. By the Common Law no personal chattel could be taken under this writ that was not in its nature properly capable both of manual seizure and sale, but by 1 and 2 Victoria, c. 110, sec. 12, the sheriff may now upon a fieri facias take any money, bank-notes, bills of exchange, or other securities for money belonging to the party against whom the writ is sued out, and may also sue upon such bills or securities in his own name, paying over the money to be recovered thereon to the creditor. If the sheriff is unable to sell the goods at a reasonable price, he may make his return upon the writ, that they remain in his hands for want of buyers, upon which the party suing out the execution may proceed to take out a writ of *venditioni exponas*, and under this latter writ, called a Writ *assistant*, the sheriff is bound to sell them for the best price, however inadequate. [EXECUTION.]

Fieschi, GIOVANNI LUIGI DE, Count of Lavagnì (1523-1547), belonged to a noble Genoese family, which had numbered two Popes in its ranks. He adopted the French and democratic views in the politics of his country, and hated the Dorias, who represented the aristocratic party. He formed a conspiracy with his brothers and friends for introducing the French supremacy, and, with a view to obtaining possession of the persons of the Dorias, he invited them to a banquet, which, however, they refused to attend. He then seized the arsenal, and in the endeavour to board some galleys in the port he was drowned, and, though the conspiracy succeeded for the moment, the power of the Dorias remained unshaken. Fieschi's life has supplied a motive to both poets and prose-writers, the most notable of the latter being Mascardi, who wrote upon it in 1629.

Fieschi, JOSEPH MARIE (1790-1836), was born in Corsica, and enlisted at eighteen in the army of Murat, King of Naples. He served in Russia, but appears always to have been a black sheep, and in

1816 was condemned to ten years' imprisonment for forgery. In 1830 he managed to obtain by fraud a government appointment in Paris, but was dismissed. In 1834 he fired a kind of gun with twenty-four barrels from a house as the king, Louis Philippe, and his retinue passed. The king was grazed, and eighteen people were killed, and Fieschi himself wounded. He was tried and executed.

Fiesole (the ancient *Fenula*) is an Italian town situated on the top of a hill above the Arno, 3 miles W. of Florence. It is a small town of no importance except for its historic associations. There are remains of Etruscan fortifications, and of a Roman theatre. The cathedral of 1028 is a basilica, with a remarkable crypt. Sulla settled his veterans here, and here Catiline, the conspirator, took his stand. The town was the native place of the painter known as Fra Angelico, and for a time the home of W. S. Landor.

Fife, a small kind of flute, with a compass two octaves from D on the fourth line of the treble clef. Fifers were employed at an early date in the British army; they were discontinued in the reign of James I., but revived in 1747, and now form part of all cavalry and infantry regiments.

Fife, or **Fifeshire**, is a coast county of Scotland, lying between the Firths of Forth and Tay, and is 43 miles long, with a breadth varying from 17 to 6 miles. It is bounded on the N. by the Tay and the counties of Perth and Kinross, on the S. by the Forth, on the E. by the German Ocean, and on the W. by Clackmannan and a part of Perth, and contains 316,089 acres. The surface varies, having the Lomond Hills (1,720 feet), Largo Law (1,020 feet), and Norman Law (850 feet), with mosses, moors, and rocky hills in the W.; while the Howe of Fife is a beautiful valley, fertile and well cultivated, 10 miles long and from 2 to 3 broad, on each side of the Eden. Another river is the Leven, and they both have good salmon-fishing. While the shore of the Firth of Tay is cold and barren, that of the Firth of Forth is very fertile, and produces splendid crops. Cattle and sheep-rearing is much carried on, and the coast fisheries are extensive. Coal, iron, limestone, and freestone are worked, and there are many blast-furnaces. The county is renowned for its linen manufacture, of which, among the many towns of the county, Dunfermline and Kirkcaldy are the chief seats. The capital is Cupar, and the University of St. Andrews is the oldest in Scotland. There are two parliamentary divisions, each of which returns one member. **Population** (1901), 218,840.

Fifth Monarchy, the millennium or personal reign of Christ on earth, which was looked for in the time of Cromwell by the sect called "Fifth Monarchy Men." The four preceding "monarchies" were those of Assyria, Persia, Greece, and Rome, enumerated in the Book of Daniel. These enthusiasts would acknowledge no human ruler, and organised risings in 1657 and 1661, which were, however, unsuccessful.

Fig (*Ficus Carica*, said to derive its name from the Hebrew *Fig* and the district of Caria) is a

deciduous tree, not exceeding 20 or 30 feet in height, belonging to the mulberry family. It has an acrid milky juice, rich in caoutchouc, and containing a peptic ferment, so that meat wrapped in its leaves is rendered tender. Its leaves are scattered, three to five-lobed, and rough, and its minute flowers are monœcious and form a hollow capitulum, top-shaped or pear-shaped, and almost closed above. This is axillary and bears male flowers chiefly near the upper end of the cavity. The common receptacle ripens like a true fruit, its chlorophyll changing colour and much sugar being formed, whilst the numerous small round fruits or "seeds," each really containing a seed, become imbedded in the pulpy interior. These changes seem independent of fertilisation; but if not fertilised the figs are said to drop off, and from early times in the Ægean it has been the custom to place boughs of the wild fig or *caprifig* over the cultivated trees in order that certain hymenopterous insects of the genera *Blastophaga* and *Sycophaga* may crawl into the receptacles of the cultivated plants. It is disputed whether or not this process of *caprifig*ation, as it is termed, has any efficacy, and whether the insects carry the pollen and so secure fertilisation or hasten maturation by puncturing the receptacle. The fig seems to be a native of Syria, but spread in prehistoric times into Persia, Greece, Northern Africa, and France. It is frequently mentioned in the Bible. Attic figs became so celebrated that laws were passed prohibiting their exportation, to which we owe the word "sycophant," for a base informer. Romulus and Remus were said to have been suckled under a fig-tree; Bacchus was crowned with its leaves; and Cato stirred up the Romans to undertake the third Punic War by exhibiting a fresh fig from Carthage, their too-near rival city. Introduced into England, probably in 1548, by Cardinal Pole (trees planted by him are still living at Lambeth), the fig is cultivated near Worthing and elsewhere in the south of England, but suffers much from frost. Some 160,000 cwt. of the dried fruits, valued at £250,000, are imported annually, chiefly from Smyrna and Portugal. They are dried in the sun, the best kind, known as Eleme, being "pulled" out flat during the process. Containing 57.5 per cent. of glucose or grape-sugar, which forms a white powder on the surface, and 6 per cent. of albumen, figs form a principal article of food in the Levant. Medicinally figs act as a gentle laxative and enter into the confection of senna, whilst from the time of Hezekiah one of the "fruits" cut open has formed a popular cataplasm for boils and sores. The spongy wood of the tree is used in France saturated with oil and emery and used as a hone.

Figaro, a character in Beaumarchais' *Barbier de Séville* and *Mariage de Figaro*, represented at Paris in 1785. Figaro is a cunning knave, who knows how to take advantage of circumstances. The Parisian newspaper of that name was founded in 1854.

Fighting Fish, the translation of the Siamese name of *Betta pugnax*, a small fish of the Acanthopterygian family Labyrinthici. An artificial

variety of it is reared for fighting in Siam, where encounters between these fish are a favourite amusement. When the fish is quiet it is dull-coloured, but if it sees an antagonist or its own image in a looking-glass, "the whole body shines with metallic colours of dazzling brilliancy, while the projected gill-membrane, waving like a black frill round the throat, adds something of grotesqueness to its appearance." In this state it makes repeated darts at its real or reflected antagonist.

Figueras, a frontier town of Spain, is in the province of Gerona, 20 miles W. of the town of that name, and is situated on a cultivated plain which produces olives and rice. The manufacture of leather and paper is carried on, and there is some trade with France. There is a strong and well-entrenched fortification, and the citadel accommodates a large garrison. The town was several times taken and retaken during the Peninsular War.

Figuiet, Louis, a French writer and man of science, born (1819) at Montpellier, where he became professor of pharmacy in 1846. He was afterwards appointed to a similar post at Paris. He has written upon alchemy, the immortality of the soul, modern science, etc., and several of his works have been translated into English. He died in 1894.

Figurate Numbers are special series of numbers of interest in the Calculus of Differences. *Triangular* figurates are based on the series of natural numbers 1, 2, 3, 4, 5, . . . and may be calculated by a set of successive additions. Thus the fourth number of the series is the sum of the numbers 1, 2, 3 and 4; the fifth is the sum of the first five, and so on. Thus starting with

1 2 3 4 5 6 7 etc.,

the first order of triangular figurates is

1 3 6 10 15 21 28 etc.,

the second order is

1 4 10 20 35 56 84 etc.,

the latter series being obtained from the preceding in precisely the same way. *Square* figurates start with the series

1 3 5 7 9 11 etc.,

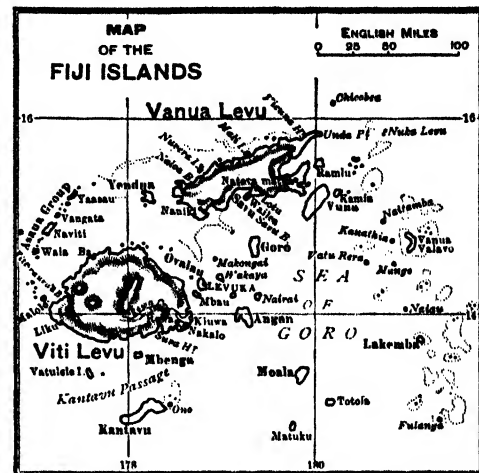
the difference being 2 between consecutive numbers. *Pentagonal* figurates have as basis the series whose common difference is 3, and so on for higher series.

Figure, in *Geometry*, means any combination of points, lines, areas, or solids. It need not necessarily be continuous from one part to another.

Figure-head, an ornamental figure at the head of a ship, immediately below the bowsprit. It usually represents the object, person, or idea which gives its name to the vessel.

Fiji, a group of islands in the South Pacific Ocean, which have lately come into prominence on account of their having been ceded to England. They lie between lat. 15° 30' to 19° 30' S., and long. 177° to 178° W. Of the 260 islands only 80 are inhabited, and the whole group is divided into two groups, the Eastern and the Western. The two largest of the islands are Viti Levu and Vanua Levu, and there are about a dozen other important islands. The islands are volcanic in origin, and there are basaltic

peaks some thousands of feet in height. Rich foliage covers the islands, which are surrounded by coral reefs, and have shores sometimes precipitous, sometimes covered with fine coral sand. The soil is fertile, and produces abundantly cocoa-nut palm,



FIJI ISLANDS.

Type. Kitching Co. & Co.

bread-fruit, and banana. Among cultivated productions are the orange, yam, maize, tobacco, and sugar-cane. There are some good timber trees. The pig is much used for food, and fish and birds are plentiful. One great industry is the preparation of copra. The people often live in palisaded towns, each of which has one, if not more, spirit-house for the worship of a deity. The chief towns are Sava, Vanua, and Levuka, which has a good harbour. It was in 1874 that England, after repeated offers from 1859 downwards, accepted the government of the islands.

Fijians (*Kai-Fiji, Kai-Viti*), the inhabitants of the Fiji Archipelago, South Pacific Ocean, who occupy a somewhat intermediate position between the black populations (Melanésians) of the western groups (Solomons, New Hebrides, New Caledonia, etc.), and the large brown Polynesians of the eastern groups (Samoa, Tonga, Tahiti, Hawaii, etc.). The Aborigines appear to have been distinctly Melanésians, who have been variously modified by contact with Polynesian intruders, especially from Tonga; hence they now exhibit every shade of transition between the two types, black colour and frizzly hair predominating in the western, brown and lank hair in the eastern members of the group. In general they are a large, muscular race, and although formerly pronounced cannibals, display more intelligence, physical and mental energy than any other group of South Sea Islanders. The language, which belongs to the Melanésian branch of the Malayo-Polynesian family, is spoken in as many as fifteen distinct dialects, of which four have been reduced to writing by the missionaries;

the literary standard is the Mbau of the Rewa delta, south-east coast of Viti Levu, and into this the Bible has been translated. Viti and Fiji are the same word, the Melanesian *f* of the western group being replaced in the eastern group by *v* introduced from Tonga. Before the British annexation (1874) the Mbau were the ruling people, and it was their king, Thako-mbau, who ceded the archipelago to England. There were forty distinct tribes altogether, of whom the most powerful, next to the Mbau, were the Mbena, Mba, Narua Nadroga, Vudd, Rakeraki, Vura, Mbua, Mucua, Cucadrove, and Lakemba; total population (1901), 120,124, of whom 94,397 are Fijians proper. (Waterhouse, *Fiji, its King and People*; Miss Gordon Cumming, *At Home in Fiji*, 1882; De Ricci, *Fiji*; Calvert and Williams, *Fiji and the Fijians*.)

Filaria, a minute nematoid worm belonging to the genus *Filaria*, has been found in the blood of human beings affected with the disease called chyluria. It has been named by its discoverer, Dr. Lewis, of Calcutta, the *Filaria sanguinis hominis*. The parasite appears to affect only the inhabitants of tropical and subtropical countries. Many of the lower animals harbour parasites belonging to the genus *Filaria*. [GUINEA-WORM.]

Filbert, a barbarous corruption of the French *feuille*, a leaf, and the English word *beard*, applied to those varieties of the cultivated hazel (q.v.) in which the leafy husk, or cupule, projects beyond, and is so contracted as to entirely enclose the nut. There are three chief varieties: the "white," the "red," and the "frizzled," named from differences in the testa or "skin" of the kernel. Some 600 tons are grown annually, especially round Maidstone, in Kent. When quite ripe they will keep for several years if in a dry place.

Fildes, SIR LUKE, R.A., an English figure-painter, was born (1844) in Lancashire. He studied at South Kensington and at the Royal Academy, and his designs for woodcuts often appeared in *Once a Week*, the *Cornhill Magazine*, and the *Graphic*, and he illustrated Dickens's fragment of *Edwin Drood*. In 1868 he exhibited *Nightfall* at the Royal Academy, and later his *Applicants for Admission to the Casual Ward* and the *Widower*. He has since devoted himself much to portraits and figures of Venetian life. He exhibited five portraits in the Academy, 1892. He was knighted in 1906.

File Fish, any individual of the genus *Balistes*, of the family Sclerodermi, with about thirty species, from tropical and subtropical seas. There are strong teeth in both jaws, by which these fish break off the coral, or crush the shells of the molluscs, on which they feed. The first of the three dorsal spines is rough in front, whence the popular name. They are also called Trigger-fish, from the fact that the second dorsal spine must be pushed down before the first can be depressed, the second spine being compared to a trigger. Two species, *B. maculatus* and *B. capricus*, sometimes occur on the British coast. All are unfit for food.

Files are special cutting tools worked by hand. They present flat or rounded surfaces of steel,

uniformly covered with small teeth. These have been produced by repeatedly striking the steel with a special chisel so as to raise regular burrs of sharp metal. File-cutting by machinery is attended by many difficulties that have not yet been completely overcome. The temper of the file must be accurately adjusted; if too hard the teeth are brittle, and tear off; if too soft the teeth flatten down, and the file is quickly rendered useless. Files are classified according to their shape, size, and cut. The ordinary shapes are too familiar to need description. *Single-cut* files have their teeth cut in rows of one direction only; *double-cut* files have in addition another series of parallel rows intersecting the first series, and made of somewhat smaller teeth. The fineness of cut ranges from 20 to 250 teeth to the inch. The teeth are sharpened by the process of sand-blasting (q.v.)

Filibusters, a kind of buccaneers, who did much injury to Spanish commerce in the West Indian seas. The term is probably derived through French and Spanish, from a Dutch word akin to the English "freebooter." The modern filibusters are adventurers who seek to upset the government of a foreign state—as, for example, the American William Walker, who made himself ruler in Nicaragua in 1855-58.

Filicaia, VINCENZO DA (1642-1707), an Italian poet, was born at Florence. He composed poems in Latin and in Italian, and some odes that he wrote upon the defeat of the Turks by John Sobieski and the Duke of Lorraine were printed in 1684. The Queen of Sweden, Christina, and the Grand Duke of Tuscany both befriended the poet, and he was eventually made governor of Pisa. His works were collected by his son Scipio, and published as *Poesie Toscane di Vincenzo da Filicaia*.

Filicinae, the name of one of the main divisions of the Pteridophyta. It is characterised by its relatively large and well-developed leaves; and by the sporangia being borne on the under surface or on the margin either of ordinary leaves, or of some specially modified but not confined to one region of the stem. In most of them the spores are all of one kind (*isosporous*); but the Rhizocarpace or Hydropteridace, including the Salviniaceæ and Marsiliaceæ, are *heterosporous*—i.e. have male microspores and female megaspores. In most of them also the sporangia originate from single epidermal cells, like trichomes (q.v.), or are *lepto-sporangiate*; but in the Ophioglossaceæ and Marattiaceæ they are *eusporangiate*, or originate from a group of cells, like a leaf-structure. One of the most recent classifications presents them as follows:—

SERIES A.—ISOSPORIA OR HOMOPORIA. SERIES B.—HETERO-
SPORIA.
Sub-series 1.—Leptosporangiate.
Class.—Filices (true ferns).
Sub-series 2.—Eusporangiate.
Order.—Marattiaceæ.
Order.—Ophioglossaceæ.
Class.—Rhizocarpeæ.

Filigree consists of fine gold or silver wire worked up by plaiting and soldering into a kind of network, of which crosses, earrings, and other

ornaments are made. Another kind of filigree-work is made by soldering wires or metal plates on to articles with a solid basis, so as to form an ornamental pattern on the surface. The art was carried to a high pitch of excellence by the ancient Greeks and Etruscans. It was also cultivated in the Middle Ages, especially among the Scandinavians and Irish Celts; and it still exists in India and Central Asia, as it did at a remote period of antiquity. The chief seats of the modern industry are Malta and the towns of North Italy.

Fillan, ST., the name of two saints. (1) Also called Faolan, the leper, had a church at Loch Erne, in Perthshire, and a healing well. There is also a seat known as St. Fillan's chair, and he had also a church in Queen's county, Ireland. (2) An 8th century abbot, son of St. Kentigern of Inch-calleoch, in Loch Lomond. He, too, had a church in Strathfillan, Perthshire, and a linn in the Dochart glen which worked cures. His quigrich, or crosier-head, was entrusted by Robert Bruce to a family who still possess it.

Fillmore, MILLARD (1800-1874), a President of the United States of America. After spending his early years in wool-carding, carefully educating himself in the intervals of labour, he turned his attention in 1819 to law, and in 1823 was called to the bar of New York. In 1828 he became a member of the State Legislature, and in 1848 was Vice-President of the Union. In 1850-53 he was President, and became unpopular in the North through his advocacy of the fugitive-slave law. When the Civil War broke out he took no active part, but used his influence upon the side of the Union.

Filmer, SIR ROBERT, who died 1653, was a Royalist of the Stuart period. He was educated at Trinity College, Cambridge, and was knighted by Charles I. He wrote a work called *Patriarcha*, in which he advocated the extreme doctrine of Divine right, considering the country to be the king's family, and the patriarchal family with all its *patria potestas* to be the model of political rule. The book has no great pretensions either in style or argument. Sir Robert had the courage of his opinions, and is said to have been plundered ten times, and to have been imprisoned in Leeds Castle for his loyalty to the losing cause. The family still retains the old seat and estate at East Sutton, in Kent.

Films. In photography, films, usually of sensitised gelatine, are frequently used in place of the ordinary coated-glass plates, for the production of negatives. Many different varieties of films are in use; paper is very frequently used as a support for the gelatine, either rendered transparent by vaseline, etc., or capable of being stripped off from the film after development as in the Eastman stripping film. They possess the advantages over glass of (1) being less liable to cause "halation," (2) possessing less weight, and (3) admitting of use in lengths or rollers. They are hence very popular amongst touring photographers, with whom portability is a great consideration.

Filter is an instrument for the purification of

water or other fluid. When water containing suspended particles of solid matter is passed through porous material such as powdered charcoal or unglazed earthenware, the passage of the solid matter is arrested and the liquid passes through in a state of greater purity. It is found also that a portion of those ingredients that are held in solution, and that therefore present no solid obstruction, is retained by the filtering medium. And further, organic impurity in the water may be oxidised and so destroyed by passage through a medium like charcoal, which possesses to a remarkable degree the power of absorbing air and of oxidising matter brought in contact therewith. On such principles are modern filters constructed, the chief practical difficulty being that of clogging; the pores of the filter are apt to become closed up by the impurities arrested, and the instrument ceases to act with sufficient rapidity. For the purification by filtering of large quantities of water such as are passed along the mains of a water company, *filter-beds* or reservoirs of special construction are used. The impure water as gathered in from the river or other source passes into a large basin and heavy sediment is allowed to settle down; the water is then passed into another basin the bottom of which is covered with successive layers of large stones, pebbles, gravel, and fine sand. In passing through these layers the water is well purified of suspended matter. Nearly the whole of the filtration occurs in an extremely thin layer at the top of the filter-bed, which rapidly becomes clogged with sediment and vegetable matter. At intervals of from one to three months a layer of about half an inch thickness of the fine sand is scraped away, this process being repeated till it becomes necessary to spread a fresh layer of sand over the filter-bed. The dirty sand is oxidised by exposure to the air, and after being well washed it may be again used. Filters such as are required for household purposes do not vary much in design. An efficient filter may be cheaply made with an ordinary flower-pot. The hole is blocked up with a piece of sponge, a layer of pebbles is placed at the bottom, and this is covered with a layer of fine gravel. Over this is spread powdered charcoal to a depth of four inches, and this is protected by being covered with another layer of small pebbles. The charcoal requires occasional renewal, but the periods of such renewal are much farther apart if the water passes into the filter from another pot, the hole of which is plugged with sponge. Filters of ordinary manufacture are much the same in principle as the above. The charcoal is sometimes compressed into a solid, porous mass, but to no great advantage. The means adopted to prevent clogging are generally such as force the water to flow upwards through the filter, leaving the sediment at the lowest layers to fall back into the water below. Air is to a great extent purified of deleterious gaseous animal and vegetable products by being passed through a sieve filled with small fragments of charcoal. A sieve of fine muslin is found effective in purifying air of suspended solid particles of soot, etc., but it rapidly becomes filthy if used continuously in any large town.

Filter Pump, an instrument in extensive use in chemical processes of filtration. Ordinary solid substances suspended in liquid are generally separated out by the chemist by filtering through specially-prepared blotting-paper. A circular disc of the paper is folded and wrapped round the inside of a glass funnel so as to fit closely against its sides. The liquid being then poured into the funnel, passes slowly through the paper and down the tube, leaving the solid matter behind. If the process is slow on account of viscosity of the liquid or the clogging nature of the solid, the process is hastened by the filter pump, which is an arrangement for producing a partial vacuum at the lower end of the funnel and so for sucking the liquid down through the filter. It is then necessary to strengthen the lower parts of the filter-paper by using a little cone of platinum foil at the apex of the funnel. In rougher operations with the filter pump the filter paper is entirely dispensed with, a small sieve of china taking its place.

Finch, any bird of the not very strictly defined family Fringillidae, which is nearly universal in its distribution, and characterised by a stout conical beak, and toes adapted for climbing, the hinder toe usually the longest. They feed principally upon seeds. Most of them are monogamous, and they usually build elaborate nests. The principal members of the family are dealt with under their popular names.

Finch, HENRAGE (1621-1682), was born in Kent, and educated at Westminster and Christ Church. He was called to the bar in 1645, and after the Restoration was appointed Solicitor-General, in which office he took part in the trial of the regicides. In 1670 he became Attorney-General, and in 1675 Lord Chancellor, and was made Earl of Nottingham. He seems to have been a good orator, and a sound and upright lawyer.

Finder is a small telescope ranged parallel to every large one for the purpose of locating that portion of the field of view which it is desired to examine. The larger instrument takes in a smaller area, and therefore would require much moving about to locate an object. But by pointing the finder at this object, the telescope must also be directed towards it, for the two are kept parallel to each other. As the finder and the telescope are concentric, when the object viewed is at the centre of the finder (marked by intersecting lines), it must be within the field of view of the telescope.

Findlater, ANDREW (1810-1877), a man of letters, was born in Aberdeen, and educated at the university there. He at first studied theology, and then became a schoolmaster. From 1842-49 he was head-master of Gordon's Hospital, Aberdeen. He then spent some time in Canada, and in 1853 took work in the house of Messrs. Chambers. Besides other work, he edited the *Encyclopædia*, contributing many of the articles himself, a matter for which his all-round knowledge eminently fitted him. He also collaborated in preparing for the press James Mill's *Analysis of the Phenomena of the Human Mind* (1869).

Fine. A species of assurance of real property which was commonly in use for conveying estates of freehold, prior to, but which was abolished by, the "Act for the abolition of fines and recoveries and for the substitution of more simple modes of assurance," passed in 1833. It was an amicable arrangement (*finis concordia*) of a suit either real or fictitious, but usually the latter, between the demandant and tenant, with the consent of the judges, and enrolled among the records of the Court. Its modern substitute and equivalent is a disentailing deed, executed by the tenant in tail and enrolled, but in which the protector of the settlement has refused to concur. If a married woman levied a fine, she forfeited all her rights in the land, but the necessity of obtaining the consent of the judges afforded a sufficient protection of the rights of the lady. Its modern substitute is a deed acknowledged before a judge or duly authorised commissioner. [ESTATE.]

Fingal, the chief hero in the poems of Ossian (q.v.). The real Fingal was a King of the Leinster Fenians; but the Fingal of Macpherson's work is made to be king of an imaginary Morven, which may have been intended for a part of Argyle.

Fingal's Cave, a most remarkable cavern, named after the hero of the poems of Ossian, on the east side of the small island of Staffa, one of the Inner Hebrides. It has been hollowed by the action of the sea out of a sheet of Tertiary basalt with vertical columns. The entrance is an irregular arch 53 ft. broad and 117 ft. high. The interior is 250 ft. long.

Fingo (*Fingou, Ama-Fingo*), the collective name of a number of broken Kafir tribes, dispersed at the beginning of the present century by Chaka, founder of the Zulu military power in south-east Africa. In response to their appeal for protection from their Zulu-Kafir persecutors many were removed by the English Government in 1835 to the district now known as Fingoland between the Kei and Bashi rivers east and west. Here most of them have been converted by the Protestant missionaries; they are industrious agriculturists and stock-breeders, doing a considerable export trade in farm produce with Cape Colony. All the children attend the missionary schools regularly, and many display some talent for literature and music. The Ama-Fingo, that is, "Mendicants," "Suppliants" (from *fengusa* = to seek service) are increasing in numbers, having advanced from 74,000 to over 90,000 in the last thirty years.

Finial, an ornament in Gothic architecture, placed on some lofty or conspicuous part of a building, such as the apex of a gable or summit of a pinnacle. It generally has the form of a knob, which is carved in imitation of foliage. It was introduced in the 12th century, and was much used in the Decorated style; the finials of that period exhibit great variety and skill in their workmanship. It survived the decay of Gothic architecture, but entirely lost its beauty of form; in Elizabethan buildings it was usually made on a

geometrical pattern, while at a later period the place of the finial was taken by a ball or obelisk.

Finistère, a French department at the west extremity of France, bounded on all sides, except in the E., by the sea, and having an area of 2,595 square miles. Tall granite cliffs deeply indented by the waves form the coast, and on the west are the roadstead of Brest and the Bay of Douarnenez. Two chains of hills, those of Arré in the N. and the Montagnes Noires farther south, both sending out many spurs, render the department very hilly. The navigable rivers are the Aulne, Elorn, and Odet, and there are many smaller streams, and a canal between Brest and Nantes. About a half of the surface is cultivated, and produces good wheat, rye, and oats, with potatoes and flax, and a good deal of cider is made. There are good sardine and other fisheries on the coast. Among the minerals are iron, zinc, and bismuth, and the lead mines of the department are the richest in France. There is a good deal of ship-building, and there are manufactures of sail-cloth, linen, paper, tobacco, and leather.

Finisterre, CAPE, a promontory at the north-western extremity of Spain, 38 miles west of Santiago, off which, in 1747, Anson utterly defeated the French under Admiral Jonquière.

Finland, a Grand Duchy subject to the Russian crown, contains 144,200 square miles, and is divided into eight governments. It is generally considered as made up of three parts:—First, the part ceded by Sweden in the 18th century; second, the rest of Swedish Finland, which was ceded in 1809; and third, the part of East Bothnia and Lapland, which was ceded in the same year. The country is bounded N. by Norway, S. by the Gulf of Finland, E. by Russia, and W. by Sweden and the Gulf of Bothnia. The surface is mostly low-lying, and has no hills of any importance, but there are very many lakes, the principal of which are Enara, Ulea, Saima, and part of Ladoga, and there are several rivers, the chief being the Tornea, Kumo, Kymmene, Kemi, and Ijo. Some of the soil is cultivated, and there is a large class of small peasant proprietors. Finland has vast forests, more than half of which belong to the State, and the cutting of the timber is carefully regulated. The Scotch fir and Norway spruce are the most widespread and most productive. The fauna is exceedingly rich. Iron and copper are among the minerals, and there are granite quarries which produce huge blocks. There is a good deal of fishing, which gives employment to a considerable proportion of the population. Helsingfors, the capital, is a fine town, and the country contains some good fortresses, and is well provided with railways and telegraphs. The inhabitants are mostly Finns and Swedes, who are generally Lutherans, and a few Russians and Germans. By various decrees from 1899-1903 the powers of local self-government which Finland possessed were taken away, but in 1905 the Czar restored the independence of the Finnish army, re-established the irremovability of the judge, and granted the demand of the people for the

restoration of legislative independence. A Diet or National Assembly was established, and the responsibility of the Secretary of State to the Diet was admitted. The members of the National Assembly are elected by universal suffrage for three years. Every Finnish citizen (man or woman) aged twenty-four can vote. Every citizen entitled to vote is eligible to the Diet, the members of which receive £56 for each session. At the first election in 1907 twenty-two women were returned as members of the Diet. The Czar, who has been Grand Duke since 1809, summons and may dissolve the Assembly; certain legislative measures are brought forward by the Ministers as propositions from him, and the Government is responsible to him as well as to the Diet. But the Diet can decide on any motion not affecting fundamental laws or the organisation of land and sea defence. Pop. (1905) 2,892,088.

Finland, GULF OF, is an arm of the E. side of the Baltic Sea, bounded N. by Finland, S. by the Governments of Esthonia and St. Petersburg. The Gulf is 260 miles long from E. to W., 80 miles wide in the widest part, and 40 miles wide at the entrance. The Neva is the only river of importance flowing into it. There are several islands in it, Cronstadt being the largest, and, besides St. Petersburg, it contains the towns of Revel, Fredricksham, Helsingfors, Viborg, and others.

Finlay, GEORGE (1799-1875), a historian of Greece from the time of the Roman Conquest downwards. He was born at Faversham, his father being an inspector of the Government powder-mills. He was privately educated, and studied law at Göttingen. But the affairs of Greece absorbed his attention, and in 1823 he went there full of grand ideas as to the freeing and regeneration of the country. He wrote *Greece under the Ottomans*, *The Byzantine and Greek Empire, 716-1453*, *Greece under the Ottomans and Venetians*, and the *History of the Greek Revolution*.

Finnish Race. In etymology the term Finn, the *Chude* of the Russians, is applied not only to the indigenous inhabitants of Finland [FINNS], but in a much wider sense to a whole group of allied peoples, who form collectively the Finnish branch of the Ural-Altaic (Mongolo-Tatar) family. In this sense they answer approximately to the Scythians of the ancients, and the Russian *Chude* is itself supposed by some writers to be a corrupt form of this word *Scyth*. At the dawn of history a great part of north-east Europe and of north-west Asia was certainly occupied by peoples of Finnish speech, most of whom have since been dispersed partly by great movements of migration southward (Magyars to Pannonia, now Hungary; Bulgars to the Lower Danube and others), partly by Mongolo-Tatar encroachments from the east, and Sla (Russian) conquests from the south-west. Nevertheless numerous fragments, and even compact masses of Finnish peoples are still found scattered over North and Central Russia and Siberia, east to the Yenisei basin. (Al. Castren: numerous work on the Finnish peoples and languages, all i

German, published at Leipzig and St. Petersburg between the years 1841 and 1862. H. H. Howarth, *The Finns and some of their Allies*, Journal of the Anthropol. Institute, 1871: Max Müller, *The Last Results of the Researches respecting the Turanian Family of Languages*, 1865.)

Finno-Tatars. 1. The collective name of all the peoples who form the western division of the Mongolo-Tatar or Ural-Altai family. Of this division, which extends from the Lena basin, East Siberia, to Lapland, and from the Arctic Ocean to Asia Minor and the Balkan Peninsula, the chief branches are:—(1) *Samojedes*; (2) *Finns*; (3) *Ugrians*; (4) *Tatars* or *Turks*. For details see under the several entries. 2. In a narrower sense, the expression Finno-Tatars is applied to several groups of eastern Finns in the Volga and Ural basins, who have become more or less assimilated in appearance and language to the surrounding Tatar populations. Such are the *Bashkirs*, numerous in the governments of Orenburg, Perm, Viatka, and Samara; the *Mescheryaks* of Orenburg; the *Chuvashes* of Kazan, Simbirsk, Samara, and Saratov; and the *Tepyaks* of Orenburg; total population 1,600,000.

Finns, properly the indigenous inhabitants of Finland, who are fundamentally of Mongolic stock and speak a Finno-Tatar language, as distinguished from the *Finlanders*, who are Swedish intruders settled on the west and south coasts since the 14th century. *Finns*, though known to Pliny and Tacitus (*Fenni*, *Finna*), is not the national name, but is supposed to be of Germanic origin, meaning aptly enough people inhabiting fens, though there are philological objections to this derivation. It has, however, the same sense as the national name *Suomalaiset*, which also means "fen people," from *suoma*, a fen or marsh. Owing to long contact with the surrounding Slav and Teutonic populations, the modern Finns have been largely assimilated in appearance to the ordinary Caucasian (European) type, and are now distinguished by grey or blue eyes, chestnut and in the west even flaxen or towy hair. But the prevalence of high cheek bones, rather broad features, scant beard, and brachycephalic (round) heads betrays their Mongolic descent, apart from their absolutely Mongolo-Tatar speech. They fall into five main ethnical groups, which would appear from their national traditions to date back to remote times:—(1) The *Finns* (*Lapps*) of Lapland [*Lapps*]; (2) the *Karelians* (*Kaunulaiset*) of Bothnia, with small enclaves in Sweden and Norway; (3) the *Tavastians* of the central and south-western lacustrine districts, who call themselves *Hämeleiset*, or "lake people," from *hæme*, "lake." The Tavastians, the "white-eyed Chudes" of their Russian neighbours, are usually taken as typical Finns—broad, squat, stout figures, small and slightly oblique blue eyes, light flaxen hair, fair complexion ("blonde as a Finn," say the Russians), but lacking the transparent rosy colour, the blush of the Anglo-Saxon and North German peoples. Morally also the Tavastians are dull, lethargic, somewhat passive and patient, honest

and trustworthy, but suspicious, sullen, and revengeful—altogether true Mongols in temperament; (4) the *Karelians* (*Karjalaiset*, probably "herdsmen," from *Kari*, a cow) of Karelia, that is, all south-east Finland stretching into Russia proper as far as Lake Ladoga, and formerly extending to the White Sea ("Karelian Sea") and including nearly the whole of the government of Olonetz.



A TAVASTIAN FINN.

The Karelians differ strikingly from the Tavastians, being much taller and slimmer, with more regular features, straight grey eyes, brown complexion, and chestnut hair hanging in ringlets down the shoulders. They are also more active, cheerful, enterprising, courteous, and intellectual. Kalevala, the hero of the national epic poem, was a typical Karelian; (5) the *Ingrians* (*Ighers*, *Igers*) of Ingermanland, that is, the district at the head of the Gulf of Finland, which was ceded to Russia by the treaty of Nystad (1721). Most of the Ingrians and many of the Karelians have been absorbed in the surrounding Russian populations; but the Tavastians, representing the Conservative side of the Finnish character, have hitherto tenaciously preserved the national sentiment, language, and traditions. Despite the pressure of Sweden on the west and Russia on the east, and although they have enjoyed little political autonomy for the last thousand years (the Swedes had already founded Abo, the historical capital, in the year 1300), the Finns still stand out as a distinct European nationality, and continue to cultivate with success their harmonious and highly poetical language. Since the 12th century they have been Christians, converted to the Catholic faith by "Saint" Eric, King of Sweden, and later to Lutheranism, again by the Swedes. The University of Helsingfors (removed thither from Abo in 1827) is a centre of much scientific and literary activity, and here was issued in 1849 the first complete edition of the

Kalevala, a national epic of some 23,000 verses, that has been compared by some scholars to the *Iliad* and the *Mahābhārata*. Of sixty periodicals appearing in Finland rather more than half are in Finnish, the rest in Swedish.

Fins, a loose term, including the limbs and locomotive outgrowths of Fishes (q.v.) and Cetacea, the dorsal and caudal crests of some Amphibians, and the swimming organs of some Molluscs, though Woodward notes that the use of the word in this last sense is misleading.

Finsteraarhorn, the highest peak of the Bernese Alps (q.v.), has a height of 14,026 feet.

Fir, a popular name often applied to all the true Conifers (*Abietinae*) or restricted to the spruces (*Picea*) and silver firs (*Abies*). These two genera agree, and are distinguished from pines and larches by having their narrow, needle-like leaves arranged singly—i.e. not in tufts. Their cone-scales also do not become thickened into a woody "apophysis" at their apex. They are conical trees with regular pseudo-whorls of branches, which themselves branch horizontally so as to form a "spray." In *Picea* the ripe cones hang downwards and fall off whole, and the leaves are arranged all round the shoots: in *Abies* the cones are erect and their scales fall off separately, whilst the leaves are in two distinct rows. Of the former genus, the most important is the Norway Spruce (q.v.), *P. excelsa*, other species being the Black and White Spruces (*P. nigra* and *P. alba*) of north-eastern North America. Of the latter, the Silver Fir (*A. pectinata*) is the type, other species being the Balsam Fir of Canada (*A. balsamea*), *A. pinsapo*, *A. portmanniana* and other ornaments of our parks and gardens. The Silver Fir, a native of Central Europe, has two broad white lines along the under surface of its leaves. The wood is less resinous than spruce, but "Strasburg turpentine" exudes from its bark. From *A. balsamea* Canada balsam is similarly obtained. The Hemlock Spruce (q.v.) (*Tsuga canadensis*) of eastern Canada and the Douglass Spruce or Oregon Pine (*Pseudo-tsuga douglasii*) of the Rocky Mountains, a valuable timber-tree, hardy in the British Isles, belong to allied genera. [BALSAMS, PINE, SPRUCE.]

Firdausi, otherwise ABUL KASIM MANSUR (931-1020), a Persian epic poet, was born at Khorassan. Study of the history of Persia gave him the idea of embodying it in verse, and he went to the court of Mahmud, who set him about his desired task, and in the course of years he produced a historical poem of 60,000 verses, containing the history of the Persian kings from the beginning down to 632 A.D. The history of Rustam, the Hercules of Persia, is one of the episodes. The Emperor did not keep the promise he had made of a gold piece for each verse, and the poet struck out an eulogy he had made of the Sultan, and made a satire upon him. He then fled into retirement, and Mahmud repenting sent presents, which arrived in time to meet Firdausi going to his tomb. A good edition of the poem was issued in 1829 by

Captain Macan, and parts have been translated into English.

Fire concerns the anthropologist, because its possession is said to mark off man from the lower animals, since, though they appreciate its warmth, even the anthropoid apes are incapable of making fire for themselves, or of keeping it up when it has been made. Wilson (*Prehistoric Man*, i. 136) says that man may be appropriately designated "the fire-using animal." Moreover, man's first acquaintance with fire is the subject of many myths, of which the classic story of Prometheus, a variant of an older Aryan myth, is the best known. Somewhat similar stories are current in Polynesia and in China. The first mention of fire in the Hebrew Scriptures is "the flaming sword which turned every way to keep the way of the tree of life" (Gen. iii. 24). There is nothing about fire in the account of the sacrifices of Cain and Abel, though it is stated (Gen. iv. 4) that "the Lord had respect unto Abel and his offering." But "answering by fire" is of frequent occurrence in the historical books (1 Kings xviii. 24; 1 Chron. xxi. 26; cf. Matt. iii. 11; Acts ii. 3).

We first meet with stories of fireless tribes in Plutarch, and in modern times travellers have again and again brought home accounts of peoples among whom the use of fire was unknown. But after patient sifting, authorities have declined to receive their stories—of course, without any imputation of bad faith, believing them to be based on imperfect observation or untrustworthy reports. It seems, however, to be clearly established that down to the middle of the 19th century the Tasmanians and Australians preferred carrying fire about with them to procuring it by artificial means.

The oldest method of fire-making is that by friction, and of this there were three or four ways. The simplest was that called by Dr. Tylor the *stick and groove*. Two pieces of wood, one hard and the other soft, were taken, and the former was rubbed up and down upon the latter till sparks were produced and tinder ignited. An advance on this was the *fire-drill*, which has a much wider range, and has undergone many modifications. The materials were the same, but a rotary motion was substituted for the rubbing backwards and forwards.

In the primitive fire-drill the stick was twirled between the palms, and in other forms string or a bow was employed. This method was used to procure the *need-fire*, probably a survival of some kind of sun-worship, and intended to secure cattle which were driven through it from murrain. To the fire-drill probably succeeded flint and pyrites (the fire stone), and Homer and Virgil mention flint as containing the "seeds of fire." Burning-glasses as means of kindling fire were known in classic times, and it is said that the Vestal Virgins procured fire by these means, though one account states that the priest of Vesta used a fire-drill.

Fire has also a religious importance. In many vanished faiths it was the chief means by which sacrifice was offered to the gods, and was—and, indeed, still is in many places—an object of worship

either independently, or as an emblem of the Sun-god or Supreme Deity. Fire worship seems to have had a wide range among the Aryans, and to have been practised in Mexico and Peru. The Greeks and Romans had special fire-deities; and the cult still lingers in the East, and seems to have left its impress on Christianity itself in the Roman Catholic practice of kindling the new-fire on Holy Saturday.

Fire Box is that portion of the boiler of a steam-engine that contains the fire. For economy of the heat generated therein the fire-box is best surrounded on nearly all sides by water-spaces. In England, and wherever coal is burnt, the fire-box of a locomotive is built of copper plates, for flaws in iron become larger under the action of intense heat, and the heat-conductivity of iron is not so good as that of copper. The box is flat-sided, and therefore liable to be crushed in by the great external steam pressure. It is in consequence strongly braced to the outer shell of the boiler by copper or iron bolts, and the top or *crown* is stiffened by ribs of wrought-iron. The *grate* is a few inches above the *ash-pan* , and is provided with a series of parallel wrought-iron fire-bars. Besides the fire-door through which the fuel is passed, a door opens below to the ash-pan to act as a damper in regulating the air-supply to the furnace.

Fireclay, a special kind of clay capable of resisting the action of fire. It is much used where protection from such action is desirable, and *fire-bricks* of various kinds are employed extensively in furnaces, chimneys, etc., that are composed chiefly of fire-clay. It is found in thin beds in the coal measures, occurring in most places where coal is obtainable. The chief British centres of supply are in the neighbourhood of Stourbridge in Worcestershire, Newcastle-on-Tyne, Gartsherrie near Glasgow, and Poole in Dorsetshire. Stourbridge fire-clay is largely exported.

Firedamp is the ordinary term for the inflammable gas that occurs in coal mines, which is such a source of danger from explosion.

Fire Engine, a machine designed to extinguish conflagrations. It pumps a continuous jet of water upon the fire by means of a force-pump worked by hand or steam. The principle being so simple, the history of the fire-engine extends far back in the past. Hero of Alexandria, writing about 150 B.C., describes a double-action pumping-engine that is but slightly different from the manual of the present day. The sketch shows the general arrangement of a simple manual. A long lever *hh* is worked up and down about an axis through its centre, and gives an alternating motion to the pistons in the pumping cylinders *cc* . Water

is supplied to these cylinders through the supply-pipe shown in section at *s* , and, by means of the usual force-pump arrangement of valves, is drawn up through *s* and pumped into the central air-chamber *a* . [PUMP.] This is so called because it contains a quantity of compressed air that prevents the entire filling of the vessel. The delivery pipe passes from this air-chamber, and is supplied with the high-pressure water which the chamber receives. And though the water is pumped into the chamber discontinuously, by reason of the air cushion it emerges therefrom in a continuous stream and at a sufficient pressure to

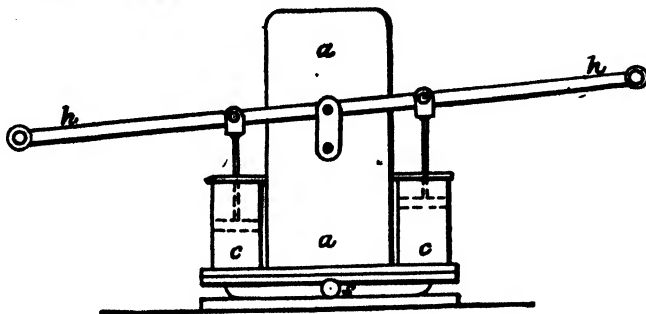


DIAGRAM OF SMALL MANUAL FIRE-ENGINE.

a, Air-chamber; *cc*, pump cylinders; *hh*, pumping levers, with transverse handles; *s*, supply-pipe.

throw itself up to a considerable height. The supply pipe is stiffened with wire, and does not need to be very flexible; the delivery pipe or hose is made of canvas lined with indiarubber. Fire-engines worked by steam are merely steam force-pumps, provided like the above manual with the air-chamber to act as an accumulator. They are more powerful, and when well in action more effective. But their extra weight and mechanism involve more time in getting them to work, and the smaller manuals are often preferable. The latter may be set going almost immediately they arrive, whereas good steam fire-engines require from 5 to 15 minutes to get up steam.

Fire Extinguishers. Various forms of fire extinguishers have at times been devised and patented. Most consist of vessels charged with solutions which upon heating evolve large quantities of gases which do not support combustion, *i.e.* do not allow other substances to burn in them, such as carbonic acid, CO_2 , sulphur dioxide, SO_2 , etc.

Fire Flies, a group of beetles belonging to the family *Elateridae* and the genus *Pyrophorus*. Most of the species are American, but some are common in Southern Europe. The pale green light from which they derive their name arises from two small spots on the suture between the thorax and abdomen. [GLOWWORM.]

Firensuola, AGNOLO (1493-1545), an Italian poet and author, was born at Florence of a family which came originally from Firensuola, a town in

the Apennines. He studied at Siena and Perugia. He took Pietro Aretino as his guide, philosopher, and friend, and the pupil is said to have done justice to the master's teaching. He practised law for a time, and is said to have died an abbot. He wrote satirical and burlesque poems, and translated into prose the *Golden Ass* of Apuleius; and wrote comedies, and *Æsopian* fables of animals, and tales after the manner of Boccaccio. His language and style are so good that he is regarded as a classical model.

Fireship, a vessel filled with combustibles and explosives, and sailed, or allowed to drift, alongside an enemy, there to explode. Fireships were successfully employed against the Armada in 1588, in the destruction of French ships under Cape La Hogue in 1692, by Lord Cochrane in Basque Roads in 1804, and on many other occasions; but they were also used by the Rhodians B.C. 190. They are now obsolete.

Firkin, a measure of capacity, the fourth part of a barrel. It contains 9½ imperial gallons, or 9 gallons of the old ale and beer measure, answering to 8 gallons of the old ale measure in use before 1803, when the same measure was adopted for ale and beer.

Firmament, an ancient name for the vault of heaven. It is derived from the Vulgate or Latin translation of the Bible, in which the word *firmentum*, denoting something solid and fixed, is used to translate the Hebrew term for the sky and stars. The latter expresses a different idea—that of extending by beating out. In ancient and mediæval times the sky was believed to be a solid revolving sphere of crystal, in which the stars were fixed, sharing its motion round the earth. When the difference in the planets' courses was observed, a new theory grew up, according to which there were several "crystalline spheres," each containing a certain number of fixed stars. The common notion was that there were nine, the nearest being that of the moon and the outermost the *primum mobile*, which set the others in motion. Heaven was somewhere beyond the *primum mobile*. This view of the universe—known as the "Ptolemaic system"—was upheld by the Church long after it had been dispelled by the discoveries of Copernicus and his followers. Any opinion which contradicted it was regarded as heretical, since it appeared incompatible with the statements of Scripture.

Firman, a word of Persian origin, denoting an edict issued by an Eastern potentate or governing body, used especially of the decrees of the Ottoman Porte. In Turkey every firman is signed by the Minister to whose department it relates, but a cipher must be affixed by a special Minister appointed for the purpose before it can become valid. A firman differs from a *hatti-sherif* in that the latter is signed by the sovereign himself, and is irrevocable. Passports and other licences granted by the Sultan are also called firmans.

Firolids, the family of Heteropoda (q.v.), including those which are shell-less or have only a small shell. They are all elongated in form and

free-swimming in habit. The two best-known genera are *Carinaria* and *Firola*, both of which live in the Mediterranean and the tropical parts of the Atlantic.

Firoz-Khoi, a numerous people of the Murghâb valley, province of Herat, North Afghanistan. They are settled in the territory of the Zeldnat Eimaks [EIMAK], with whom they are grouped by Elphinstone and other authorities; but the Firoz-Khoi are not Eimaks or Hazâras, but true Persians both by descent and speech. They form two main divisions—Mahmudi and Dezai, with 30,000 tents, or total population 150,000 to 160,000. (*Invalide Russe*, 13-25 April, 1879.)

Firospur, an Indian district of Lahore, forming a commissionership under the Lieutenant-Governor of the Punjab. It occupies an area of 2,740 square miles, between lat. 30° 18' to 31° 10' N., and long. 74° 5' to 75° 29' E. The surface is generally level, with the exception of a few sand-hills and part of it is watered by the Sutlej. The district is healthy and, for most part of the year, dry, and produces wheat, barley, and other grain. There is a little cotton- and wool-weaving, and the Lahore road is the chief trade-route. The inhabitants are chiefly Mahometan, with some Hindoos.

First-born, a Biblical term for the first offspring of man or beast, which the Lord claimed as a tribute from the Israelites (Exodus xiii. 11-16). It is interesting to note that, long before the law was given, the sacrifice of Isaac (Sarah's eldest son, though not Abraham's) was demanded; and it may be that the law, with its provision for the redemption of male children, involves a reminiscence of the practice of the ancient Semites, who seem to have carried their human sacrifices to the highest pitch of abnegation, as among the Phœnicians none but only-begotten children could be offered to the gods.

First-fruits, an offering to God required by the Hebrew law, and consisting of the first gatherings of the harvest, or of food made therefrom. They were of two kinds, public and private, and each class included both *Bicurim*, a raw produce, and *Terumoth*, produce prepared for human use. The public offerings were four—the first-fruits of all ripe fruits and liquors, presented in God's house; a sheaf of corn at the Passover; two loaves of leavened bread at the Feast of Pentecost; and the harvest offering at the Feast of Tabernacles. Among private offerings were the first-fruits of all lands, and a cake made from the first dough which was baked.

Fir Volgs, or FIRBOLGS, a race who overran Ireland, probably during the period now known as the Bronze Age. They are supposed to have been Britons. According to tradition, they were led by five chieftains and made their appearance in three bodies, which landed in Wexford, Mayo, and Ulster respectively. They were themselves vanquished by another invading race, the Tuatha Dé Danaum, but there are traces of them long afterwards, and they are believed to have formed the chief element in the Irish population as late as the 6th century.

Fischart, JOHANN (1545-1589), a German satirical writer, was born at Mainz. Not much is known of his life, except that he was a Doctor of Laws, and in the latter part of his life was bailiff of Forbach. His satires, partly verse, partly prose, are humorous and sometimes obscene, and attack freely the follies of his time. He was a sort of German Rabelais, and took great liberties with his native tongue, being compared in this respect to Aristophanes. He wrote an imitation of Rabelais, and one of his chief works was *Das gluckhafte Schiff von Zurich*.

Fischer, ERNST KUNO BERTHOLD, a German philosopher, born in Silesia in 1824. He was educated at Leipzig and Halle, where he studied philosophy, and in 1850 established himself in Heidelberg as a *privat-docent*, but three years afterwards the Government deprived him of this post, probably on account of unorthodox views. In 1856 he obtained an appointment at Jena, and in 1872 was reappointed without opposition or interference at Heidelberg. His great work is a *History of Modern Philosophy*, in which he treats of Spinoza and the Cartesians, of Leibnitz, of Bacon and his successors, of Kant, of Fichte, and of Schelling. He also wrote other books, especially a *System of Logic and Metaphysic*. He has had great influence upon German contemporary thought.

Fish, HAMILTON, an American statesman, was born at New York in 1808, and called to the State bar in 1830. He was returned to Congress in 1842, and in 1847 became Lieutenant-Governor, and Governor in 1848. In 1853 he became a member of the United States Senate, and from 1869-77 was Secretary of State, in which capacity he was concerned in the Washington treaty of 1871, and in the settlement of the *Alabama* question. He died in 1893.

Fish Hawk, Fishing Eagle. [OSPREYS.]

Fish Owl, a name for two genera of Owls (q.v.). Ketupa from India, and Scotopelia from Africa. Fish is their favourite diet, but when this fails, no kind of animal food comes amiss to them.

Fisher. [PEKAN.]

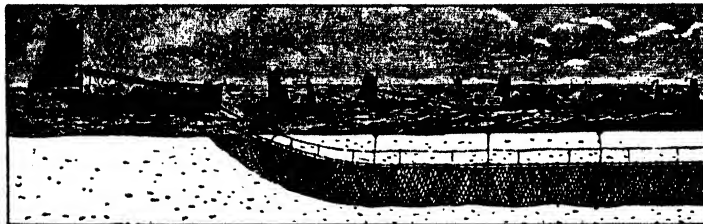
Fisher, JOHN (1459-1535), an English ecclesiastic, was born at Beverley, in Yorkshire. He was educated at Cambridge, and obtained a fellowship, and became head of a house. He took orders, and became confessor to the Lady Margaret of Richmond, and was the first Margaret Professor of Divinity. He became Chancellor, and in 1504 was nominated Bishop of Rochester. He was a great opponent of Protestantism, but, on the other hand, was consistent, and refused to look on the king's marriage with Katharine of Aragon as unlawful. The Court party determined his destruction, and first attained him in 1534 as an accomplice of the Maid of Kent. He was sent to the Tower,

and deprived for refusing to recognise the king's new marriage, and when the Pope sent him a cardinal's hat in 1535 the king declared he should have no head to wear it on. Accordingly he was trapped into denying the king's spiritual supremacy, was tried, condemned, and beheaded. He left behind him a commentary upon the Penitential Psalms, and other theological writings.

Fisheries. The regular pursuit of fish for food or as a commercial commodity evolved with the growth of society from an individual act to satisfy an individual want to a complex collective business, from fishing to a fishery. The process is easily traceable among living nations. Fishing has naturally had an important place among the industries of maritime countries. In some cases—Holland and Scotland, for instance—it has figured prominently in the national history; in some others—notably Newfoundland and the Behring Sea—it has caused serious international disputes.

Value of Sea Fisheries. To measure the value of inland fisheries, except in a few cases, is impossible; but the Board of Trade is responsible for the following official estimate of the most important sea fisheries, the figures representing the total value at first hand:—United Kingdom, excluding Scotch and Irish salmon (1908), £10,512,431; Canada (1906), \$26,279,485, Norway (1906), 33,179,300 kroner. For U.S. and Holland we have no official estimate; the fisheries of the former probably equal our own in value, while the Dutch range after the Norwegian. The value of our own fisheries in the wholesale markets is probably quite fifteen millions sterling. The most important single fisheries of other nations are as follows: Canada—cod, pickled herring and mackerel, and preserved salmon and lobster; France—"prime" fresh fish, cod, oyster, herring, sardine; Norway—cod, herring, mackerel; Holland—cod and herring. The American shad, Dutch oyster, and Italian sardine are also familiar and valuable. The United Kingdom fisheries employ 107,000 men, the Canadian 64,000, and the Norwegian about 104,000. The Arctic whale fishery has gradually declined owing to the scarcity of fish and the increasing use of other oils and gas.

British Inland Fisheries. These being mainly used for sport only call for brief mention. The salmon (q.v.) is, however, commercially important, the annual value of the market consignments being about £200,000. Scotland sends 25,000 one-cwt. boxes, Ireland 10,000, and England 2,750, to



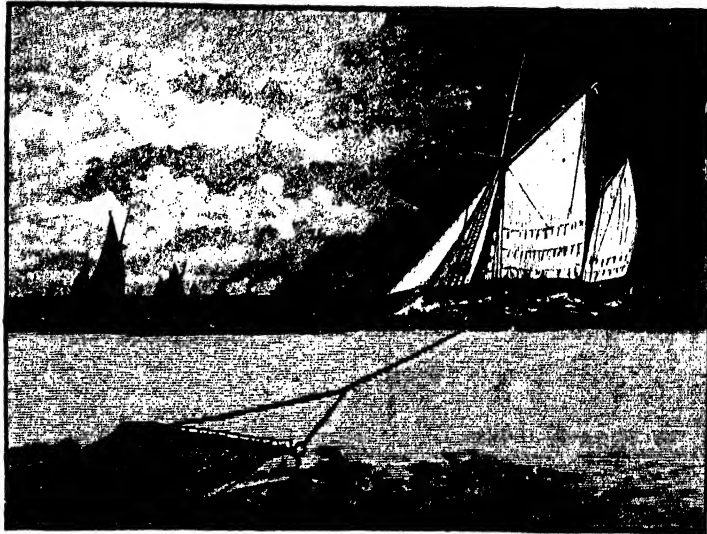
DRIFT-NET FISHING

Billingsgate annually. Pollution of rivers has done much mischief. The chief British salmon streams are the Tay (which alone gives an annual rental of nearly £17,000), the Spey, Tweed, and Esk, the Shannon, the Severn, and the Tyne.

The *British Sea Fisheries* are pursued mainly according to five methods. Of these trawling has become the most important. The trawl-net is a long bag, depending from a beam from 15 to 50 feet long and raised 3 or 4 feet from the ground at each end. It is dragged along the sea-bottom for several hours at a time; and when hauled in the

season is from August to October; the spring fishery is less important. Yarmouth and Lowestoft are the chief English centres. Mackerel is caught almost exclusively on the south and west coasts from May to autumn.

The seine net, of which there are several varieties, is made to encircle the fish, not to enmesh them; it is leaded so as to float perpendicularly, being shot in a circle if worked from a boat, or in a semicircle if worked from shore. It is used largely on the Cornish coast for mackerel, pilchard, herring, and sprat.



TRAWLING.

lower or "cod" end is unlaced and the catch discharged. The trawl can only be used on soft, flat bottoms; it takes bottom fish, that is, all the flat food fish: sole, plaice, turbot, halibut, brill, flounder, skate, etc. Beam-trawling has rapidly increased during the last decade, especially at the ports nearest to the great North Sea "banks," Hull and Grimsby, Shields, Aberdeen, and Leith. Steam-trawlers are gradually supplanting the old sailing vessels; and fast steam "carriers" attend the big fleets of the fishing companies and take their catches to market. The operation of "boarding" the boxes of fish from the smack to the carrier is constantly one of the dangerous parts of the fisherman's vocation. Oysters (q.v.) and shrimps are taken with smaller forms of the trawl-net.

In drift-net fishing the fish—surface fish, especially herring, mackerel, pilchard, sprat, smelt, and whitebait—enmesh themselves in the net, which, like a curtain, drifts perpendicularly with the tide a few feet below the surface. A fleet or train of herring nets extends $1\frac{1}{2}$ miles, and one of mackerel nets often over two miles. Herring fishing takes place at night-time, and usually within 30 miles of shore, the catches being landed daily. The chief

Line-fishing with hook and bait is mainly used for cod, haddock, ling, and halibut. A full train of "long" lines measures over six miles, and carries nearly 5,000 hooks, mussels, whelks, etc., being used as bait. "Hand" lines are much shorter. Cod-smacks are built with a "well" in which the fish are kept alive till landed, when they are transferred to large floating chests to await market exigencies. Large steam vessels now go long voyages, especially to Iceland and the Faröes from Grimsby and Aberdeen.

Fixed nets and engines include stow-, trim-, and kettle-nets, weirs, trammels, and crab and lobster pots.

The Fishing Fleets.—Nearly 25,000 fishing-boats were registered in the United Kingdom in 1907, the regular crews numbering over 105,000. This, of course, represents only a small part of the whole population employed. England has 9,100 boats (mostly of large size) and 38,000 hands; Scotland 8,800 boats with 42,800 hands; and Ireland 6,800 boats (very few of the first class) with 23,000 hands. The chief English centres are Grimsby (which boasts itself the metropolis of the fishing world) with over

800 boats and 5,000 regular fishermen, Hull with 550 boats (500 of them "first-class") and 2,800 hands, Yarmouth with 680 vessels, and Lowestoft with about 400. The most valuable single fisheries from English and Welsh ports are haddock, cod, herring, and soles. The total value of sea-fish landed on the English and Welsh coasts in 1908 was £7,739,534. Of the fish brought to England about 80 per cent. in value are landed on the east coast. "Prime" fish is getting scarcer and dearer.

In Scotland almost all the fisheries ports are on the east coast. Banff and Peterhead have each about 1,100 boats, Inverness 1,800, and Wick, Stornoway, Kirkcaldy, and Greenock large fleets. Aberdeen is developing a large beam-trawling business. Of £2,511,492 worth of sea-fish landed in Scotland in 1908 the herring contributed about half. The haddock fishery is rapidly growing. Herring-curing engrosses in the season the energies of whole communities. It has been so often described as to be familiar. The Government Brand, established in 1809, has since 1858 contributed substantially to harbour works, etc. It is not compulsory, but is of obvious value as a certificate of quality in the Continental markets, whither 98 per cent. of the branded barrels are sent. The total Scotch cure has multiplied fifteenfold since 1809, and doubled in the last twenty years; it now amounts to about 1,350,000 barrels annually. Besides the regular fishermen, over 52,000 persons are intermittently employed in connection with the Scotch fisheries, chiefly in the summer herring season.

The leading centres in Ireland are Dublin with 146 first-class boats, Galway with a thousand small boats, Skibbereen, Westport, Sligo, Londonderry, and Cork. The total value of fish landed in 1908 was only about £261,431, and of this sum mackerel contributed nearly half. Only half the boats engaged in the Irish mackerel fishery are Irish; there are many French visitors. Kinsale, Castletownbere, Baltimore (where there is an admirable fishing school), and Valentia are the principal landing-places. Part of the mackerel catch goes direct to the English markets, and part is salted and barrelled for America.

Administrative Aspects. The economic importance and the scientific interest of the fisheries have both been more widely appreciated in recent years. The example of the United States and several Continental Governments has not been altogether lost. We have, however, still quite a number of scattered authorities acting in a disjointed and ineffective way; and we are not yet through the pre-scientific period of inquiry by Royal Commission and Parliamentary Committee. Things were hardly bettered by the transfer of English fisheries business, in 1886, from the Home Office to a new, but small and ill-equipped, department of the Board of Trade. By the Board of Agriculture and Fisheries Act of 1903 the duties of the Fisheries Department were transferred to the Board of Agriculture, the designation of which was at the same time altered to the Board of Agriculture and Fisheries. The Fisheries Division is charged

with powers and duties under the Sea Fisheries Acts, the Salmon and Freshwater Fisheries Acts, and certain Acts relating to Shell Fisheries. A primary distinction must here be noted between national and international—i.e. territorial and extra-territorial—waters; the former extend 3 miles from the land, beyond which limit all fishing is free save as it may be regulated by International Convention. The most important of these Conventions are that of 1882, providing for the policing of the North Sea, and that signed at the Hague, in 1887, for the prohibition of the drink traffic among fishing boats. Under the Sea Fisheries Regulation Act of 1888 a chain of local committees has been gradually formed round the English and Welsh coasts; and these have power to restrict or prohibit particular methods of fishing in territorial waters, and to protect and develop shell-fisheries. The latter object is also provided for under the Oyster, Crab, and Lobster Act of 1877, etc.

Scotland has long enjoyed a more sensible administration. In 1882 the old "Board of White Fishery" was supplanted by the new Fishery Board, which at once adopted a larger programme. Surveys of fishing grounds, careful and sustained scientific investigations, and experiments in "pisciculture" (q.v.) have been set afoot. The other duties of the Board—beside the working of the herring brand—have meantime increased. Under the Act of 1885 it may regulate or prohibit inshore fishing; it manages the numbering, etc., of boats, collection of statistics, settlement of disputes, and granting of loans to fishermen, and advances for harbour works and telegraph extension. All the powers of the Board of Trade respecting shell-fisheries have been given over to it. It has its own officers in twenty-six districts. Proposals have several times been before Parliament for the re-organisation of the Board on a representative basis, the creation of district committees, and the development of shell-fisheries through their agency. Professor Ewart and other members of the Board have found time to help forward the movement for the technical education of fishermen. The Scotch salmon and freshwater fisheries are administered by the Fishery Board and district boards acting mainly under the Acts of 1862 and 1868, the inadequacy of which is a subject of complaint. (See Mr. Archibald Young's report to the Board in 1890.) The right of salmon fishing is the property of the Crown, being granted or leased by the Commissioners of Woods and Forests; it is "emphatically an heritable estate," and is commonly subject to lease. Scotch rights thus differ from English, which are held by the Crown only in trust for the people, and are really public. The Tweed and Solway Fisheries are under special legislation; and this fact, and the differences between English and Scots law, have given rise to endless litigation. (See Stewart's *Law of Fishing*, and Report issued in 1890 of Commission on Crown Rights of Salmon Fishing in Scotland.)

The Irish fisheries have suffered at the hands of English governors. In 1819 a Fishery Board was established to extend to Ireland the system of bounties which England and Scotland had already

enjoyed, and the enormous impetus given to the industry lasted long after its cessation in 1830. No compensating grants were established, as in Scotland, and the famine of 1847-48 commenced the decay which steadily continued for a number of years. The Fishery Board was re-established in 1869, and loans and grants made out of the Irish Reproductive Loan Fund (1874) and the Sea Fisheries Fund (1883). The superintendence of the Irish fisheries is now entrusted to three inspectors who constitute the Fisheries Department of the Government offices at Dublin Castle. These officials act together as a body, and have jurisdiction over both sea and inland fisheries, upon which they make a report annually to the Lord-Lieutenant of Ireland. The richness of some of the Irish fishing grounds is beyond question; but better railway service between coast and markets, better boats, instruction in net- and line-making and fish-curing, a more vigorous initiative in public oyster farming, a thorough survey of the western waters, and an all-round strengthening of the Fishery Department are sadly needed.

The Fishmongers' Company—which is one of the oldest of the metropolitan guilds—occupies a sort of semi-official position. Its main public duties are now the inspection of London fish-markets, and condemnation of "unsound" fish, the prosecution of offenders under the Sea Fisheries Acts, and the suppression of the trade in "unseasonable" salmon. It also helped to launch the highly-successful International Fisheries Exhibition of 1885, the last of a series in which Arcachon (nearly twenty years before), the Hague, Berlin, Norwich, and Edinburgh were pioneers. The volumes issued by the Exhibition executive together with the annual blue-books of the various fisheries departments would alone make a goodly fisheries library. One of the results of the Exhibition was the formation of the Marine Biological Association, which has a marine "laboratory" at Plymouth. The National Sea Fisheries Protection Association, the Royal Dublin Society, the National Federation of Fishermen, and the Missions to Deep Sea Fishermen deserve mention.

The Exhaustion of Fisheries. The improvement of railway communication and market facilities, the introduction of steam vessels, and the multiplication of fleets, together with the gradual failure of inshore fisheries and the alleged strain upon the much-frequented "banks," have served to thoroughly alarm the older fishing communities, and the "immature fish question" is everywhere anxiously debated. An International Conference, at which Belgium, Denmark, France, Germany, Holland, Spain, and Great Britain were represented, was held in London in 1890, and it was resolved that scientific inquiries should be carried on in each country. Other conferences were held in 1899, 1901, and 1902. The British Government was asked to prohibit the sale of soles or plaice less than 10 in., lemon soles less than 11 in., and turbot and brill less than 12 in. in length. Of the general fact of a useless and probably ultimately disastrous slaughter there is no doubt; and, apart from immature fish, it seems certain that continuous

fishing in limited areas will prevent the natural reproduction of the less prolific species. The beam-trawler is the chief offender, for his catches particularly are of the large uncommon and valuable kinds. Of course, to stop the sale of fish under a certain size will not completely stop their capture. On the latter point little definite can be said pending further scientific researches, such as the Scotch Board, the Marine Biological Association, and foreign observers are carrying on. The relation between size and maturity is almost unknown at present; and a net which will let the young of large fish escape and yet catch the mature of smaller species is yet to be devised. To kill a nearly mature fish is worse than killing many very small ones, it should be remembered. Three suggestions can be made: (1) that the trawl should be raised more often, so that small fish may be returned to the sea before dead; (2) that known fish "nurseries" should be protected; and (3) that shrimp trawling and certain other modes of fishing in territorial waters (where, however, the valuable food-fishes rarely spawn) should be restricted or prohibited. It is possible that to some extent the food and habitat of bottom-fishes are injured by beam-trawling. It has, however, been established that it does not destroy the spawn, for Sars, McIntosh, and Raffaele have shown that the eggs of all these valuable fish float.

On these and other problems concerning fish-life, food, reproduction, migration, and artificial propagation, valuable papers will be found in the annual reports of the Scotch Fishery Board.

Fishes (*Pisces*), a class of vertebrate animals forming with the Amphibia (q.v.) Huxley's primary group or province Ichthyopsida (q.v.). Aristotle, the father of Natural History, in the 4th century B.C. knew how to separate fishes from the higher aquatic mammals and the lower aquatic invertebrates, but for a long time the term Fishes was used very vaguely. In modern times, Ray (1628-1705) seems to have been the first to attempt a separation of whales from fishes, but afterwards, as if frightened at his own daring, invented a definition which included both. However, since the days of Linnaeus, the distinction between cetaceans and fishes has been clearly made, and the biological researches of the last half of the 19th century have led to the marking off of Amphioxus and the Cyclostomata on the other side, so that the boundaries of the class may be said to be pretty clearly defined.

Fishes are aquatic vertebrate cold-blooded animals, having the body divided internally into a number of segments or myocommas, and usually covered with scales. They possess a dorsal nerve-cord, enlarged at the anterior end to form a brain, and a notochord generally replaced by a backbone. The heart consists of a single auricle and a single ventricle (except in the Dipnoi, where there are two auricles); gills persist through life. The limbs, when present, are in the form of paired fins, without true digits, and not divisible as in higher vertebrates, into arm, fore-arm, and hand, or thigh, leg, and foot respectively. Unpaired fins are often

present in the shape of a fold of the skin, supported by slender flexible cartilaginous or bony rays connected by a thin membrane.

There is evidence that fishes existed in Upper Silurian times, though this evidence is fragmentary, consisting of spines, scales, and head armour. In the Devonian, fish remains are so abundant that that epoch has been called the "Age of Fishes," and down to the end of Palaeozoic times Ganoids predominated. In secondary strata the Dipnoi and Teleostei appear, the former in the Permian, the latter not till the Chalk, and of the fossil forms in Tertiary strata more than half belong to existing genera, though the distribution was very different from that of the present day.

Fishes may be conveniently classified as follows:—

SUB-CLASS I.—PALMICHTHYSES (Ancient Fishes).

Order I.—Chondropterygii (Cartilaginous Fishes).

Sub-order I.—Plagiotomata (Fishes with oblique mouths).

Group A.—Selachoides (Sharks).

Group B.—Batoides (Rays).

Sub-order II.—Holocephala (Chimaeroids).

Order II.—Ganoides (Ganoids).

Sub-order I.—Placodermi (Bony-plated Fishes).

Sub-order II.—Acanthodini (Fishes with spines in front of some of the fins).

Sub-order III.—Chondrostei (Ganoids with cartilaginous skeleton).

Sub-order IV.—Polypteroides (Fishes with the dorsal fin greatly divided).

Sub-order V.—Pycnodontoides (Fishes with molar-like teeth).

Sub-order VI.—Lepidosteoides (Fishes with bony scales).

Sub-order VII.—Amioides (American Mud-fishes and their ancestors).

Order III.—Dipnoi (Lung-breathing Fishes).

SUB-CLASS II.—TELEOSTEI (Bony Fishes).

Order I.—Acanthopterygii (Spiny-finned Fishes).

Order II.—Acanthopterygii Pharyngoguanthi (Spiny-finned Fishes with the pharyngeal bones united).

Order III.—Anacanthini (Soft-finned Fishes).

Order IV.—Physostomi (Fishes with the air-bladder opening into the mouth).

Order V.—Lophobranchii (Fishes with tufted gills).

Order VI.—Plectognathi (Fishes with the jaws united).

As will be seen from the list given above and from the article 'ARTILAGINOUS FISHES (q.v.), the

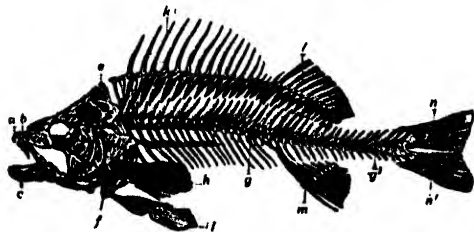


FIG. 1.—SKELETON OF PERCH.

a, Pre-maxillary bone; b, maxillary bone; c, lower jaw; d, skull; e, interoperculum; f, g, h, spinal column; i, pectoral; j, ventral fin; k, l, dorsal fins; m, anal fin, n, o, caudal fin.

skeleton of the oldest forms is composed of gristle, not of true bones, as anyone may satisfy himself by examining the skeleton of a skate. This is only to be expected, considering that the forerunners of true fishes—Amphioxus, the Hag, and Lampreys—

have no bony framework. This state of things still persists in the Sharks and Rays and in the Ganoid Sturgeons, while in other Ganoids and in the bony fishes the skeleton is more or less ossified. The Perch offers a good example of the skeleton of a bony fish.

The axial skeleton consists of a vertebral or spinal column, terminating at the anterior end by a cranium or brain-box and the bones of the face, and at the posterior end by the tail. Each vertebra

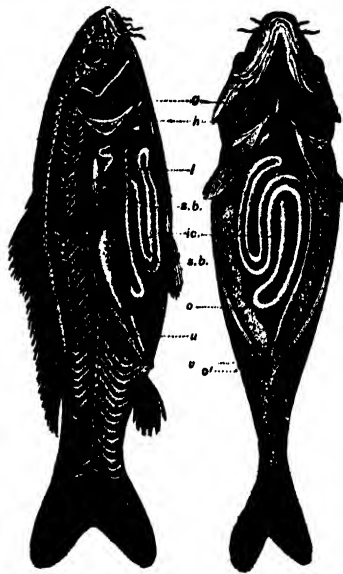


FIG. 2.—ANATOMY OF THE CARP.

g, Gills; h, heart; i, liver; s, h, swimming bladder; t, intestinal canal; c, ovaries; o', oviduct; u, urethra; v, vent.

is hollowed out before and behind (except in the American bony pike, where the front part is convex and the posterior part concave). The jelly-like remains of the notochord fill up the cavities between the vertebrae, which are bound together by ligaments, and allow great flexibility of movement. Only two regions can be discriminated in the spinal column—the abdominal and the caudal. The vertebrae in the former region possess a neural arch, through which the spinal cord passes, and two transverse processes serving for the attachment of the ribs. These two processes are wanting in the caudal vertebrae, which have, however, an inferior arch carrying a spine, and to these arches and ribs the term hæmal is applied.

There is no thoracic cavity, as in the higher vertebrates; and the ribs, which generally give off a spine-like bone posteriorly, are imbedded in the muscles. The interspinous bones above and below bear the median fins (see the bones bearing dorsal (k, l) and anal fins (m) in Fig. 1), and are connected by ligaments with the neural spines.

The skull is a brain-box formed from modified vertebrae, and bearing capsules for the sense-organs.

In Cartilaginous Fishes this brain-box is gristly, but in all others it is more or less completely ossified. In front of the brain-box are the bones or cartilages that form the framework for the mouth and face. Behind the head the gills or branchiæ are situated, and the cavity containing them opens exteriorly by the gill-slit. This is closed by the gill-cover, by which the gill-chamber can be opened or shut. The gill-cover or operculum is made up of four flat bones united by a membrane. The innermost, which articulates with the skull, is called the præoperculum, and then comes the operculum proper, the inter-operculum, and the sub-operculum.

The fins of fishes are *paired* or *horizontal*, and *unpaired* or *vertical*. The former consist of two pairs, the pectorals and ventrals, and are the representatives of the limbs of higher vertebrates; the latter are mere outgrowths of the skin supported by bony rays. The pectoral fins are carried by the scapular arch, and the ventrals by the pelvic bones, which constitute an imperfect pelvic arch, never united to the vertebral column. In abdominal fishes—those having the ventrals near the posterior end of the body—these bones are suspended in the muscles; in the thoracic and jugular fishes which have the ventrals below or in front of the pectorals respectively, the pelvic arch is attached to the scapular arch. In some fishes a sucking disk is formed by the coalescence of the ventrals. The unpaired fins are in the median dorsal and ventral line, and in their simplest form consist of a fold of skin surrounding the end of the tail. They generally consist of one or two outgrowths of skin on the back, called the dorsal fins; of similar outgrowths of the under surface near the vent, called the anal fins, and a broad fin at the posterior end of the body, called the caudal fin or tail. In addition to the rayed dorsal, many soft-finned fishes—the Salmon family, for example—have an additional fin without rays, and as this consists of a mere fold of skin containing fat, it is called the adipose fin. The adhesive disk of the sucking fishes is formed by a modification of the dorsal fins. The tail is set on vertically, thus differing from that of the Cetaceans, which is horizontal. When the lobes are decidedly unsymmetrical, the tail is said to be *heterocercal*; it is *diphycercal* if the fin rays are divided by the end of the spine into two equal, or nearly equal, portions; and *homocercal* if the notochord is prolonged into the upper lobe. The tail is the great organ of progression, the paired fins being used chiefly to direct rather than to impart motion. The body may be naked, but is generally covered with scales developed in the true skin. These differ greatly, and on their characters Agassiz (1807-1873) founded a scheme of classification on these differences, being chiefly influenced by his knowledge of fossil forms. *Cycloid* scales—those of most of the Bony Fishes—are thin and flexible, round or elliptical in shape, and generally with a smooth outline. *Ctenoid* scales have the hinder edge spinous or cut into comb-like teeth. *Ganoid* scales are angular and bony, and covered with a thin layer of enamel (ganoine). The so-called

Placoid scales are in no sense true scales, but ossified dermal papillæ (shagreen), and bony plates, which in the Rays are often armed with a spine. The principal muscle lies along the sides of the trunk and tail, and is made up of a number of smaller segments, one for each vertebra. The brain is always small, and in the adult never fills the whole of the cranial cavity. In the Pike, for example, the proportion of the weight of the brain mass to that of the whole body is as 1 to 1300; in man it is twenty-six times as much, or as 1 to 50. The whole nervous system is relatively much smaller than in the higher animals. The eyes vary greatly; they may look upwards, downwards, or sideways, be



Fig. 3.—PROTECTIVE RESEMBLANCE IN PHYLLOPTERYX.

close together, or even on the same side of the head, as in the Flat Fishes (q.v.). When they are abnormally large, it is an indication that the fish either lives at a great depth or is nocturnal. In *Periophthalmus* they can be thrust far out of the socket, and can see in air as well as in water, and in *Uranoscopus* they are so completely on the upper surface as to justify the name of Star-gazer. There are two nasal sacs, lined with membrane, with a single or double exterior orifice. Only in the Dipnoi do these sacs open posteriorly into the mouth. The passive sense of smell seems to be possessed by all, or nearly all, fishes, while the active sense of scent is probably confined to the predatory forms, as the Sharks, etc. There is no tympanic membrane or external ear. In the Cartilaginous Fishes an auditory passage reaches to or opens into the skull, where the labyrinth is situated, and in many of the Bony Fishes there are spaces in the skull near the internal ear, covered with skin or thin bone, while in others, as in the Perches, there is a connection between the swim-bladder and the ear, which seems to foreshadow the Eustachian tube. The tongue is little developed, and there is not much evidence as to the sense of taste. Dr. Günther thinks that it cannot be acute, and that a peculiar organ on the palate of Carps is connected with this sense. Most fishes are sensitive to touch, and sensory cells are distributed over the skin. Barbules—whence the popular name of the Barbel (q.v.)—and the filamentous appendages of many other fishes are tactile organs, as are the detached

rays of the pectorals in some families, though these may also be used for locomotion, as in the Gurnards. Fishes are voiceless, though some of them produce sounds, which are probably involuntary; in others the sounds are produced by the rubbing of some of the neural spines on the posterior part of the vertebral column.

The mouth is generally armed with teeth, though some fishes, as the Sturgeons, have none. The Bony Fishes have teeth not only on the jaws, but



Fig. 4.—BROAD-NOSD PIPE-FISH (*Siphonostoma typhle*) WITH YOUNG ESCAPING FROM THE BROOD POUCH OF THE MALE.

distributed more or less over the bones of the mouth. The alimentary canal consists of a gullet, stomach, small and large intestine, though in some cases these divisions are not apparent. In the Cartilaginous Fishes and Dipnoi the absorbent surface of the intestinal canal is increased by a spiral valve, which winds in close turns from the straight intestine to the cloacal vent. In the Bony Fishes its place is supplied by a number of blind tubes (the pyloric caeca), and there is no cloaca. The urino-genital pore in the class is distinct from and behind the anus, and the urinary pore is, as a rule, separate from and behind the genital. The liver is usually large, soft, and oily, and in the Cods is of importance in medicine and commercially. The kidneys are very large, extending, beneath the spine, from end to end of the abdominal cavity. They are important, because by their means biologists have been able to trace the development of the urino-genital system in the higher animals from a primitive excretory duct. The heart, except in the Dipnoi, receives venous blood only. This is poured into the auricle, thence into the ventricle, and through the branchial artery to the gills,

through which it is distributed by the branchial vessels. After aëration it is not returned to the heart, but propelled through the systemic vessels of the body. In the Dipnoi the heart receives arterial as well as venous blood. Fishes breathe by means of their gills oxygen dissolved in the water in which they live. The water flows in at the mouth, and, after parting with its oxygen, out at the gill clefts. The gills persist through life, and generally form a series of flat, elongated, pointed leaflets or plates, carried on the branchial arches, and covered with mucous membrane, through which the branchial capillaries run. In some embryonic forms the gills are filaments; in the Lophobranchs (q.v.) they are in the form of small lobes; and in the Sharks they are not covered by an operculum. The swim-bladder, arising as a dorsal outgrowth from the intestine and often communicating with the gullet, though chiefly hydrostatic in function, is the homologue of the lung, and is developed into that organ in the Dipnoi, thus linking them with the Amphibians. In fishes which live principally at the surface the swim-bladder is small, and it is absent in the Flat Fishes.

The sexes are distinct, but individual abnormalities occur, as in higher animals. In the European species of *Serranus*, a testicle-like body is sometimes attached to the lower part of the ovary, but even in this genus the sexes are generally distinct. Most of the class are oviparous; the generative organs of the female are commonly known as "hard roe," and those of the male as "soft roe," or "milt." The eggs are generally deposited in the water, a small quantity of the male element serving to fecundate a large number of them dispersed through a considerable space. In the oviparous cartilaginous fishes the egg is deposited in a flattened oblong case locally known as sea-purses, the ends of which are produced into filaments serving to anchor the case and its contents. In the viviparous sharks the posterior pair of fins are modified to form "claspers," which hold the female during fertilisation, which must necessarily be internal, when the young are produced alive (as they are also in some bony fishes) or when the ova are enclosed in cases. When hatched the young still carry the yolk-sac, which serves to nourish them till they can feed themselves; but many of them differ so widely from the parent forms that not a few have been described as distinct genera. In only two genera do the females show any care for the ova; in the Siluroid genus *Aspredo* they are attached to the belly, and in the Lophobranch *Solenostoma* a pouch is developed, probably for their reception. When any care is shown for the eggs or young, it is on the part of the male. The stickleback builds a nest, in which the ova are developed [see illustration under ACANTHOPTERYGII], as do some others; and the males of most of the Syngnathidae have egg pouches or carry the ova glued to the abdomen, and in some cases the young when alarmed seek this pouch for shelter.

Although many fishes, especially in the tropics, are brilliantly coloured, some take on the hues of the surroundings very closely, as do the flat-fishes.

Protective resemblance exists among the Lophobranchs, and is carried to a high degree of perfection in the Australian genus *Phyllopteryx*. The colour of these small fish is like that of the sea-weed among which they live, and the long waving appendages of their spines look to be vegetable rather than animal. Fishes are the hosts of many parasites—from Cyclostomes to tapeworms; and some in their turn are commensal, as *Fierasfer* with Holothurians, and the young of the bass and sticklebacks with Medusæ. Specimens of these two fish, taken from their host, are in the Natural History Museum, South Kensington. An imperfect form of hibernation occurs in many Cyprinoids and Murænoids, the vital functions being greatly lowered but not suspended. In tropical countries in time of drought many fish bury themselves in mud, and some of the Dipnoi prepare a kind of mud-case lined with hardened mucus in which they can live for some time.

Fishes may be fresh-water or marine, and some frequent the brackish water of estuaries. The

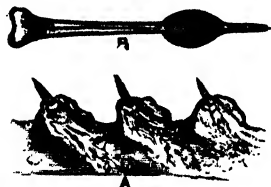


FIG. 5.—POISON ORGANS OF SYNANCEIA (from specimen in Natural History Museum, South Kensington).

A, Dorsal spines of *S. verrucosa*; B, spine dissected out, showing poison-bag.

marine fishes fall into three groups. (1) *Shore Fishes*, living in the immediate neighbourhood of the land, the majority keeping near the surface, and few descending to more than 300 fathoms. (2) *Pelagic Fishes*, living near the surface and in upper regions of the open sea, on approaching land in search of prey or to spawn. (3) *Deep-Sea Fishes*, which inhabit the depths of the ocean. Although these groups are convenient for description, they are by no means sharply defined, and pass into each other at many points. Some fishes are vegetable feeders, but the majority live on some kind of animal food—infusorians, jelly-fish, molluscs, crustaceans, small fish, and in some cases warm-blooded animals, while a few are scavengers. Fishes are economically important to man as food [FISHERIES, PISCICULTURE], and in a less degree for the oil, isinglass, and shagreen obtained from some of them. The flesh of some few fishes, however, is either constantly or occasionally poisonous, causing acute inflammation of the stomach and intestines, and sometimes death. These results are said to be due to the fact that these fish feed on poisonous medusæ, corals, or substances in a state of putrefaction. Those living on certain coral banks in the West Indies are poisonous, and during the spawning season the roe of the Barbel, Burbot, and Pike acquire deleterious qualities. Poison-organs are sometimes developed for purposes of defence, not for procuring food. These organs may consist of perforated spines connected with a poison bag, as in the Scorpionoid *Synanceia*, from the Indo-Pacific, and the Batrachoid *Thalassophryne* from the coasts of

Central America; of solid jagged spines as in the Sting Rays, where the mucus secreted by the skin is the poisonous agent; or of a grooved spine charged with a similar mucus, as in the Weever.

Fishes Royal, a name applied to whales and sturgeons, which, when caught near the coast or thrown on shore, are the property of the Crown.

Fishing. [ROD-FISHING, SALMON, TROUT, ETC.]

Fishing Frog. [ANGLER FISH.]

Fissipedia. [CARNIVORA.]

Fissirostres, a lapsed group of Passerine birds, of which the swallows, swifts, and goat-suckers were the chief representatives. The distinguishing characteristic was a short beak, wide in the gape, and bordered with bristles to prevent the escape of the insect prey.

Fistula. A narrow track communicating externally with the skin and internally with a mucous surface is called a fistula. Such a condition of things may arise from error of development, as in the branchial fistule of the neck, or may result from disease or injury. The most common form of fistula is *fistula in ano*. It owes its origin to the formation of an ischio-rectal abscess which bursts internally into the lower bowel and externally upon the skin. The unnatural track of communication thus formed is very prone to remain open, giving rise to chronic discharge of offensive matter from the cutaneous opening. Other forms of fistula are *lacrimal fistula*, where there is a track of communication between the lacrimal sac and the skin of the face, *salivary fistula*, *biliary fistula*, and the like. The cure of fistula usually resolves itself into a question of operative treatment.

Fitch, JOHN (1743-1798), was born in Connecticut, and during the Revolution was a gunsmith. He then made some expeditions to the west, and was captured by Indians, but escaped. In 1785 he made a model of a steamboat, and in 1789 made a trial trip with a steamboat on the Delaware. In 1790 he ran a passenger boat for 20 miles, and in 1793 went to France to advance his views. The Revolution upset his plans, and he came home penniless. It is a question whether later boats were not modelled upon his plans deposited in France.

Fits. [CONVULSIONS.]

Fitzgerald, EDWARD (1809-1883), an English scholar born in Suffolk. At an early age he went to France, but in 1821 he was sent to Edward VI.'s grammar school at Bury St. Edmunds. In 1826 he went to Trinity College, Cambridge, where he was contemporary and intimate with Thackeray and Thompson (afterwards Master of Trinity). Tennyson also was there at the time, but the two did not become acquainted till later. After taking his degree he adopted a quiet country life, enjoying the acquaintance of the son of Crabbe the poet, Donne, Spedding, and Thackeray. He also formed an acquaintance with Tennyson and Carlyle. In 1852 he produced the two dialogues *Euphranor* and *Polonius*. He then began to study Spanish, translated Calderon's plays, and delighted in *Don Quixote*

In 1852 his attention was directed to Persian. He studied it enthusiastically under the direction of E. B. Cowell, and translated some of the Oriental poets. His translation of Omar Khayyám is perhaps his best-known work, and is very highly thought of. He had great powers of language, and treated his originals with much boldness, not however obscuring, but enhancing, if possible, their good qualities.

Fitzgerald, LORD EDWARD (1763-1798), was brought up in France, and in 1779 entered the English army, and served in America. He then sat for a time in Parliament for Athy. When the French Revolution broke out he went to Paris. In 1793 he returned to Ireland, and in 1796 joined the Society of United Irishmen. He joined in a plot for bringing about a French invasion. The plot was betrayed, and Fitzgerald was seized after a struggle in which he received a wound from the effects of which he died.

Fitzgibbon, JOHN, EARL OF CLARE (1748-1802), Lord Chancellor in 1789, took a considerable part in the struggle for the Act of Union between England and Ireland. He was exceedingly unpopular with his countrymen, but he seems to have possessed great ability. He upheld the Union, but attacked the Whig absentees.

Fitzherbert, MRS. (1756-1837), a Roman Catholic lady, who was married in 1785 to the Prince Regent. The marriage was legally invalid, and the Prince denied its having taken place. Upon the Prince's marriage to Caroline in 1795 the pair separated, but came together again later, parting finally in 1806.

Fitzroy, ROBERT, naval officer, surveyor, and meteorologist, was second son of Lord Charles Fitzroy, and was born in 1805. He entered the navy in 1819, and became commander in 1828, captain in 1834, retired rear-admiral in 1857, and retired vice-admiral in 1863. From 1828 to 1836 he commanded the *Beagle*, in which, during part of the time, Charles Darwin was naturalist. In 1841 he published *A Narrative of a Ten Years' Voyage of Discovery Round the World*, in collaboration with Capt. P. P. King, R.N.; and in the same year was elected M.P. for Durham. From 1843 to 1845 he was Governor of New Zealand. Subsequently, as meteorological statist to the Board of Trade, he elaborated a system of barometrical theories and storm-signals, now almost universally adopted; but after he had published his *Weather Book* his reason gave way, owing to overwork, and in 1865 he committed suicide.

Fitzwilliam, WILLIAM, EARL (1748-1833), took his seat in the House of Lords in 1769, and acted in opposition to Pitt, but afterwards gave into his views, and was made by him Lord-Lieutenant of Ireland. His views upon Catholic Emancipation were too advanced for Pitt, who recalled him, and his recall was followed by the rebellion of 1798. The Earl did not again take any very active part in politics, though the Whig party did not entirely lose his services.

Fiume, a free town, and port of Hungary, on the Recina, at the N. of the Gulf of Quarnero, 46 miles S.E. of Trieste. There is an old town situated upon a hill, and a new town lying along the shore. There are two railways, and two harbours, which have been greatly improved so as to admit vessels of considerable size. Among the buildings are a cathedral, a good church, a theatre, barracks, and several schools, and in the old town is an arch said to date from Claudius II. Several foreign consuls reside in the town. The chief exports are paper, wheat, wine, tobacco, timber, salt, and hemp. There are a Whitehead's torpedo factory, Smith and Meynie's paper-mill, tobacco factories, chemical works, a steam flour-mill, and ship-building, tanning, and rope-making are carried on, and there is a trade in tunnies with Trieste and Venice. The neighbourhood is stony, the climate warm, and good wine is produced.

Five Mile Act, an Act passed in 1665, which forbade ministers to teach in schools, or reside within five miles of a corporate town, unless they took the oath of non-resistance, and subscribed the Act of Uniformity.

Fives, a game carried on by one player or several players arranged in sides. It consists in striking a ball with the open hand against a wall, either on its first return from the wall after it has been struck by an opponent, or before a second rebound from the floor of the court. The ball must not touch the wall below a certain height, or rebound more than a certain distance, the regulations in this respect differing with local usage. The game takes its name from the five fingers of the hand: it was common in France and England in the 14th and 15th centuries, under the title of "palm-play" or *jeu de paume* (now used of tennis), and is forbidden in a statute of Edward III., as interfering with due exercise in archery. It now survives only in the public schools and universities.

Fixed Air, the name given by Black to carbon dioxide, CO₂, owing to its existing in compounds in combination with magnesia, lime, and caustic alkalis, etc., or being, as he termed it, "held fixed" by these substances.

Fixed Bodies are those which remain unaltered and do not volatilise upon heating. **FIXED OILS**, similarly, are those which do not volatilise at temperatures below that required for their decomposition.

Fixed Proportions, LAW OF. [ATOMIC THEORY.]

Fixed Stars. True stars are generally called *fixed* to distinguish them from the *planets* or "wanderers," whose motions are so much more obvious. Nevertheless, though the motions of stars are apparently slight, observations extending over sufficiently long periods, and made with sufficiently accurate instruments, show that they are really moving with speeds comparable to that of the earth in its orbit. [STARS.]

Fixing, in *Photography*, is the term applied to the operation of rendering permanent the image

formed on a "negative" or positive print [PHOTOGRAPHY], by dissolving away the unacted upon and unchanged sensitive constituents. It is of course necessary that the solution used for this purpose should not act upon the deposit which forms the image itself. In those cases where salts of silver, as the chloride, bromide, or iodide, are the sensitive substances employed, as in ordinary silver prints, negatives, or bromide papers, sodium thio-sulphate ($\text{Na}_2\text{S}_2\text{O}_3$), known commercially and generally as sodium hyposulphite, is almost invariably employed. Where iron salts are used, as in the platinotype and chrysotype processes, dilute hydrochloric acid is used, while in the carbon process the print is fixed during development, as the latter consists in washing away all the unaltered parts.

Fixtures, as the name indicates, are things of an accessory character annexed to houses or lands, and in that sense they include not only such matters as grates in a house, or steam engines in a colliery, which follow in some respects the law of personal chattels, but such things also as windows and palings, which are for every purpose parcel of the realty. To be a fixture, however, the thing must not constitute a part of the soil or principal subject matter itself—*e.g.* the walls or floors of a house, being an intrinsic part of the house, are never described as fixtures—and, on the other hand, the fixtures must be in some union or connection (actual or constructive) with the principal subject matter, and not merely brought into contact with it, as in the case of a picture suspended on hooks against a wall or a wooden barn resting by its weight alone upon a brick foundation.

As to annexations made by a tenant during his term, the general rule is that he can never again sever them without the landlord's consent; the property by being annexed to the land belongs to the freeholder, and a tenant by making it a part of the freehold is considered to have given up all future right to it, so that it would be waste in him to remove it afterwards. But a tenant may so construct the erections that they shall not be deemed fixtures: thus, if he erect even buildings, as barns, granaries, sheds, and mills upon blocks, rollers, pattens, pillars or plates, resting on brick-work they may be removed, for, unless they be affixed to the freehold by being let into it, or are sure by means of nails, mortar, or the like united to it, they remain movable chattels only. The exceptions to this rule are three:—

1. *In favour of trade.* A tenant may remove such things as he has fixed to the freehold for purposes of trade or manufacture, if the removal causes no material injury to the estate.

2. *For agricultural purposes.* The Agricultural Holdings Act, 1883, gives a tenant a property in any engine, machinery, fencing, or building for which he cannot get compensation, affixed after January 1st, 1884, so that it is removable by the tenant before or within a reasonable time after the termination of the tenancy, subject, however, to the tenant paying any rent due, etc., avoiding or making good damage, giving the landlord notice

before removal and allowing him an option of purchase.

3. *For ornament and convenience.* The following are removable:—Hangings, tapestry, and pier glasses, whether nailed to the walls or panels or put up in lieu of panels, marble or other ornamental chimney pieces, marble slabs, window blinds, wainscot fixed to the walls by screws, grates, ranges, and stoves, although fixed in brickwork, iron backs to chimneys, beds fastened to the walls or ceiling, fixed tables, furnaces, and coppers, wash-tubs, and fixed water-tube, coffee and malt mills, cupboards fixed with holdfasts, clock cases, iron ovens and the like, provided the separation occasions but little or no damage. The fixtures must be moved before the tenant's term or interest expires, unless in the case of a strict tenancy at will, when the tenant may be allowed a reasonable time after his tenancy, if his interest were not terminated by his own act.

As between the heir and the personal representative, the fixtures will generally pass with the freehold to the heir, but such of them as have been put up for ornament, domestic use or trade, devolve to the personal representative, provided they can be easily removed and are not essential to the enjoyment of the inheritance.

Fjord, a long, narrow, and often very deep inlet of the sea on the west coast of Norway. Fjords are the seaward prolongations of mountain valleys, so that their depth is merely a measure of the depression of the coast. The sea lochs of Scotland, such as Loch Nevis and Loch Fyne, the loughs of Ireland, such as Lough Foyle, Lough Swilly, Bantry Bay and Dunmanus Bay, numerous similar indentations on the north-west coast of America, and such inland depressed and submerged glens as the Lake of Lucerne and Lago Maggiore, are examples of the same thing, though known by so many distinct names.

Flaccus, CAIUS VALERIUS, of the 1st century A.D., a Latin poet of whom next to nothing is known, save that he wrote a mediocre work called *Argonautica*, an account of Jason's expedition in search of the golden fleece. He may have been a friend of Martial, and alluded to in one of Martial's epigrams, but this is not certain. He is thought to have died before 90 A.D.

Flacius, MATTHIAS (1525–1575), a German theologian, was educated at Basel, Tübingen, and Wittenberg. In religious difficulties he consulted Martin Luther, and became professor of Old Testament at Wittenberg. In 1557 he was professor at Jena, but his independence of view kept him in constant trouble. He was driven out for holding Manichean views, and wandered to Ratisbon, Antwerp, Strasburg, and Frankfort-on-Main where he died. He had considerable reputation as a Scriptural interpreter.

Flag. [IRIS.]

Flag, any banner or ensign used, or intended to be used, to convey a definite meaning, as, for example, nationality, ownership, or any signal.

AS SALAR JUNG SAHADIN

Flags may be divided into national, including naval and mercantile, ensigns: flags indicative of rank or office; house flags; and signal flags; and while, strictly speaking, the word flag means a right-angled parallelogram of bunting or other suitable material, the term is also used generally to cover pennants, burgees, and, in fact, all forms of bunting employed for display. National flags, or ensigns, are ordinarily half again as long as they are broad. That part of them which is placed next to the mast or halliard is known as the "hoist," the free end as the "fly." As the proportions of the British flag differ from those of most other nations, and as, moreover, the flag itself is, more often than not, wrongly constructed, a few words concerning its form and history are not inappropriate. The essential feature in every British national flag is the "Union," which either occupies the whole field (when it forms the "Union Jack"), or is confined to the upper corner of it, next the flagstaff (when it forms the white, blue, or red ensign, as the case may be). This Union should be twice as long as it is broad. If, therefore, the breadth of the hoist be represented by 100, the length will be represented by 200. The proper width of the Red St. George's Cross is 20; that of each white border of the St. George's Cross, 6·66; that of the white St. Andrew's Cross, 10; that of the red saltire, standing for Ireland, 6·66; and that of the white fimbriation of the red saltire, 3·33. The St. George's Cross represents England. According to some, its white edging is merely a heraldic fimbriation; while according to others it represents the remains of an old French flag (a white cross on a blue field), which was utilised by England in the early days of the claim of the English kings to the crown of France. The compound diagonal cross represents not only two crosses—viz. the Irish saltire gules and the white Scots cross of St. Andrew—but also the heraldic fimbriation proper to the former when borne upon a field azure; and therefore the whole is arranged, so as to indicate its significance, in an "interchanged" manner; or, in other words, Ireland and Scotland are each given predominance in alternate limbs of the main diagonal cross. Before the union with Scotland the St. George's Cross stood alone on the English flag; subsequently the crosses of St. George and St. Andrew were blended, and in 1801 the present "Union" was adopted upon the admission of Ireland. Used alone, and covering the whole field of a flag, the Union Jack is employed extensively by the army; and by the navy is borne in every ship on the jack-staff, or forward flagstaff, as a kind of subsidiary ensign; while, hoisted at the main, it is also the badge of an admiral of the fleet. Used as forming the upper near canton of a flag, the Union is employed in three ways: firstly, in the White Ensign—a white flag which bears over its whole field a red St. George's Cross, two-fifths of the width of the ensign, and which is carried on the flagstaff or at the peak of every British warship in commission, and also, by licence of the Admiralty, by the vessels of the Royal Yacht Squadron; secondly, in the Blue Ensign, a flag which has a blue field, and which is carried by vessels officered

and manned up to a certain strength by the Royal Naval Reserve, by certain vessels chartered by Government, and by certain licensed yacht clubs; and thirdly, in the Red Ensign, a flag which has a red field, and which is the flag of the mercantile marine generally, and of ordinary yacht clubs and private craft. The Union also appears bordered in the merchant service and in some signal flags. Among British flags indicative of rank or office may be mentioned the Royal Standard; the Admiralty flag (a gold foul anchor on a red field); the Trinity House flag (a St. George's flag, with ships in full sail in the cantons); and the distinguishing flags and pennants of naval officers of various ranks. Among house-flags are the numerous distinguishing flags of the various steamship companies and yacht clubs. Among signal flags may be reckoned not only those arbitrarily arranged flags, burgees, and pennants by means of which ships at sea communicate one with another; but also national and other flags, when used, as they often are, to convey significations other than those for which they are primarily intended. Thus, any British ensign hoisted with the "Union" down is indicative of distress. The St. George's Cross on a white field began to be used as the regular English naval ensign as early as the 14th century. At the union of 1606 the ensign became "azure, a saltire argent, surmounted by a cross gules fimbriated of the second," the fimbriation being one-third the width of the red cross, and the red cross one-fifth the width of the flag; and this remained the national ensign, except during the Cromwellian period, until 1801. In that period ensigns varied a good deal, and sometimes had a harp on the fly; but the old Union was reintroduced in 1660.

Flagellants (from Latin *flagellum*, a whip), a sect of fanatics who arose in the Middle Ages, and sought by their self-inflicted castigations to atone for the iniquity of the age. Their custom was to march in procession from town to town, in garments of sackcloth with the back and shoulders left bare, carrying crucifixes in their hands or wearing the image of the cross woven on their caps. On arriving at a town they resorted to the market-place, where they prostrated themselves on the ground in the form of a cross, while each in turn lashed the others with a knotted scourge until the blood flowed. Meanwhile they never ceased their wild hymns, in which they denounced the wickedness of men and sought the forgiveness of Heaven. Each member pursued this course for 33 days—the number of the years during which Christ lived on earth. They first appeared at Perugia in Italy in 1260, whence they spread into many parts of Austria, Germany, the Netherlands, and France. As the movement extended, they adopted the most heretical tenets, rejecting the sacraments, and maintaining that the blood shed by them was as effectual as that of the Saviour in the remission of sin. On the outbreak of the Black Death the enthusiasm of the sect greatly increased, especially in Germany. In 1349 they made their appearance in England, but they never gained any firm hold in this country. A bull was issued against them by

Clement VI., and we hear little more of them till 1414, when the *Flegler* arose in Saxony under the leadership of Conrad Schmidt. This outburst was even more extravagant than the preceding one; Schmidt claimed to be divinely inspired, and denied the authority of the Church, but he and his comrades were seized and burnt. The doctrines of the Flagellants were condemned in the Council of Constance, and soon afterwards they disappear completely from history.

Flagellata, a group of Infusoria (q.v.) belonging to the division Mastigophora (q.v.), and including those forms which swim by the action of one or more flagellas. A flagellum is a whip-like filament which can be lashed backward and forward by the animal. The two best-known members of the group are *Noctiluca*, which is the principal cause of the phosphorescence of the sea, and *Euglena*, which often occurs in such abundance in stagnant pools as to colour the water green. The members of the group are all microscopic in size.

Flageolet, a wind instrument which has taken the place of the ancient flute. It consists of a mouthpiece and a tube containing six finger-holes. Its compass is a little more than two octaves upward from G on the treble stave. The tin whistle is a kind of flageolet.

Flag-Lieutenant, in the navy, a species of aide-de-camp to an admiral. He is a lieutenant, chosen for the position by the admiral, with whom he lives and messes. He is distinguished by wearing aiguillettes. A flag-officer is an admiral. A flag-captain is the captain of a ship that bears an admiral's flag.

Flagstone, a rock belonging to Lower Silurian series, so laminated that it naturally splits into thin layers or flags suitable for paving. This is a characteristic of certain sandstones, limestones, and indurated clays. Among the best known are those in Caithness and at Festiniog in North Wales. In common language a "flagstone" is any flat stone used for paving.

Flahault de la Billarderie, AUGUSTE CHARLES JOSEPH, COMTE DE (1785-1870), a French general and diplomatist, born in Paris. His father, a marshal, was guillotined in 1793. The boy went to England with his mother, but returned later to France, and took part in the Italian campaign, becoming eventually *aide-de-camp* to Napoleon. He rapidly advanced, but in 1825 he was exiled. In 1830 he returned to France, and was made a peer, and received the Grand Cross of the Legion of Honour, and was made ambassador to Berlin and Vienna. Under Napoleon III. he was made a senator, Chancellor of the Legion of Honour, and ambassador to England.

Flake White, a white substance which consists of a basic nitrate of bismuth formed by the addition of water to a solution of nitrate of bismuth, $\text{Bi}(\text{NO}_3)_3$. Its composition may be written as $\text{BiNO}_3(\text{OH})_2$, but is subject to variation. It is used occasionally in medicine, as a pigment, as a glaze for porcelain, and under various names as

"blanc d'Espagne," "blanc de fard," etc., is employed as a cosmetic.

Flamborough Head, a cape on the E. coast of Yorkshire, forming a bold headland pointing S.E., and enclosing Bridlington Bay. It is a chalk formation six miles long, and its cliffs which are in places 300 feet high, and have large caverns at the base, are the resort of innumerable sea-fowl. The lighthouse at the extreme point has a revolving light 214 feet above sea-level, and visible 30 miles off.

Flamboyant, the style of Gothic architecture which succeeded the Decorated in France, corresponding in date to the Perpendicular in England. The name is derived from *flambeau*, a torch, and is due to the waving character of the tracery in windows, panels, etc., which produces an effect like that of tongues of flame. Flamboyant architecture is in the main merely a corrupt form of Decorated, and its leading characteristic is the intricacy and superabundance of the ornamentation. The mouldings are very inferior to those of earlier styles: undue prominence is given to the large empty hollows, while the fillet is sparingly used; and the mouldings often run into one another without any dividing line, or are separated only by an arris. The pillars, which are commonly circular, usually lack capitals, and are often entirely bare; at other times the chief mouldings of the arches, instead of ceasing abruptly, are continued down the surface of the pillars. When suites of mouldings meet, they are often made to interlace, in a peculiarly intricate fashion. Two-centred arches are the most common, but the semicircle, the ogee, and the ellipse also occur. The canopies are highly finished, and are often very beautiful.

Flame. All flames consist essentially of gases heated to incandescence. In almost all cases the high temperature is due to chemical action, usually that of combination. Thus the flame of substances burning in air is formed owing to the high temperature produced by the combination of the burning substances with the atmospheric oxygen. Sir Humphry Davy was the first to carefully study the nature of ordinary flames such as those produced by a candle, etc. In the burning of a candle the melted tallow or wax, etc., is attracted up the wick, where, owing to the high temperature, it is decomposed into gaseous hydrocarbons, which by their combination with the oxygen produce the high temperature necessary for the maintenance of the flame. As combination only occurs when the gases and the air mix, the flame at the lower part is hollow, the inner portion consisting of the hydrocarbons alone separated from the atmospheric oxygen by the zone of burning gases. The flame may be divided into three portions: (1) a dark central zone surrounding the wick, which consists of unburnt gases; (2) a bright luminous zone in which combination is going on, and in which the hydrocarbons are being further decomposed, but in which the combustion is not complete; (3) an outer zone, non-luminous, or but slightly so, in which the combustion is completed. The luminosity of flame is dependent upon a number of factors—as, e.g. (1)

the temperature, (2) the density of the gases, (3) the presence of solid particles. Thus with increase of temperature, other factors being unchanged, the luminosity is increased, and flames but feebly luminous may be rendered highly so by previously heating the constituent gases; owing to this cause the flames of sulphur, etc., burning in oxygen are far more luminous than when burning in air alone. Increase of density of the gases also causes increase in the luminosity, and substances burning under pressure give in general brighter flames than those of the same substance burning under ordinary conditions. The presence of solid particles in a flame always greatly increases the luminosity, and Davy supposed it was the sole cause, but many flames are highly luminous although they contain no solid particles, as the very brilliant flame caused by the combustion of carbon bisulphide in nitric oxide. In the case of coal-gas or a candle the luminosity appears to be chiefly due to incandescent carbon particles, produced during the destruction of the hydrocarbons. Professor Frankland, however, states that his, as yet unpublished, experiments show these do not constitute "an important source of luminosity." If air be mixed with the gas before burning, as in the Bunsen burner (q.v.), the flame becomes non-luminous, owing to the more complete combustion of the hydrocarbons with less separation of carbon. Admixture with an inactive gas, as nitrogen or carbonic acid, however, also renders the flame non-luminous. In this case the effect appears to be due to the dilution of the gas with hence a lower temperature, and the spreading of the combustible material over a larger area so that it is more readily consumed by the oxygen of the surrounding air. The Bunsen flame is, however, far hotter than the ordinary gas flame, owing to the more complete combustion, and if a jet of air, or better, oxygen, be directed into the flame [BLOWPIPE], a hotter flame still is obtained. If the air is in such quantities that it is insufficient to combine with the gases, the flame contains material which can combine with oxygen, and is hence a *reducing* flame. If, however, the air is in excess, the flame contains heated oxygen, and forms an *oxidising* flame. For the continuance of a flame a certain temperature—*temperature of ignition*—is required, and if the gases be cooled below this the flame ceases. Thus a candle may be extinguished by placing a cold copper spiral around the wick, while a flame will not pass through wire gauze until the gauze is itself heated nearly to redness. Upon this fact is based the well-known Davy lamp, in which the flame is surrounded by metallic gauze. The colour of flames depends on the burning substance, and, to an extent, upon the temperature, but the chief cause of coloration of flames is the presence of foreign substances, as metallic salts, which are introduced into a flame. Thus sodium salts colour a flame yellow, strontium salts, crimson. [FLAME COLORATIONS.]

Flame Colorations, a test employed in qualitative analysis whereby certain metals are recognised by the colour imparted to the flame of a Bunsen burner, or blowpipe, when the substance

examined is heated in it. The colorations caused by the chief metals so recognised are as follows:—

Sodium	...	...	Yellow.
Potassium	...	...	Violet.
Lithium	...	...	Carmine.
Strontium	...	...	Scarlet.
Calcium	...	...	Brick-red.
Barium	...	...	Yellowish Green.
Copper	...	...	Emerald Green.
Arsenic	...	...	Lilac.
Lead	...	...	Blue.
Copper Chloride	...	...	Azure Blue.

Green flame may also be caused by the presence of borates, phosphates, or molybdates, in the substance.

Flamen, in the religion of ancient Rome, was a priest devoted to the service of some special deity. The most ancient and honoured, known as *Majores*, were those of Jupiter (*Flamines Diales*), Mars, and Quirinus; they are said to have been instituted by Numa, and were invariably patricians. The twelve other flamen (*Minores*) were chosen from among the plebeians. They were at first elected by the *Comitia Curiata*, but after 104 B.C. they were nominated by the people in the *Comitia Tributa*, and afterwards installed by the *Pontifex Maximus*. On his election a *Flamen Dialis* passed out of the *patria potestas* or control of his father, and he possessed other privileges, such as a seat in the senate, but his liberty was curtailed in many ways. For example, he might not mount a horse or spend a night outside the city.

Flamingo (*Phenicopterus*), a genus of Anserine birds, with eight species, four of which are American, the others ranging over Africa, the South of Europe, India, and Ceylon. They are often made a family; and Professor Huxley constituted for them his group *Amphimorphæ*, on the ground that they were intermediate between the Geese and the Storks and Herons. The neck and legs are very long, and the feet webbed; the bill is longer than the head, bending downwards in the middle, and furnished on each side with sieve-like plates, to act as strainers, and the tongue is armed with strong recurved spines. These birds fly well, and are good swimmers, but only in deep water, owing to their long legs. When feeding, the neck is bent, so that the head is upside down, for in no other position could they bring the straining plates into play. The food, like that of ducks and geese, consists of worms, molluscs, crustaceans, and small fishes, and is taken by the simple device of filling the mouth with water, which runs out through the comb-like plates of the bill that also serve to retain the prey. The Common Flamingo (*P. antiquorum*) is a summer visitor to the South of Europe. The plumage of the male is white with a pinkish tinge, and the wing-feathers are brilliant scarlet. The neck is extraordinarily lithe, as may be seen by visitors to the Zoological Gardens, or in the life-like sketches of the late Rev. J. G. Wood's *Explanatory Index to Waterton's Wanderings*. The nest is a conical structure of mud, and the balance of evidence seems to be in favour of the view that the hen birds sit with the legs hanging down on each side or stretched out behind.

Flaminian Way (*Via Flaminia*) was made by the Censor C. Flaminius in 220 B.C. It ran northwards from Rome through Narnia and Spolegium and over the Apennines to Fanum Fortunæ on the Adriatic, whence it skirted the coast to Ariminum. It was continued through Cisalpine Gaul under the title of *Via Æmilia*.

Flamsteed, JOHN (1646-1719), the first English Astronomer Royal, was born at Denby near Derby. He was educated at a free school, and showed great aptitude for mathematics, astronomy, and the making of mathematical instruments. In 1667 he wrote a paper upon the equation of time, and in 1673 he wrote upon the real and apparent distance of planets. Charles II. made him Astronomer Royal, and he observed at the Queen's house at Greenwich till the Observatory was built. His *Atlas Cælestis* was published in 1753, and he took a great part in preparing material for the *Historia Cælestis*. In his later years he was involved in a quarrel with Newton and Halley, but opinion has been much divided as to the relative merits of the disputants.

Flanders, or VLAANDEREN, was the name of a district of Western Europe, beginning from the Schelde just below what is now Fort Lillo and extending along the Western Schelde to the entry of the Straits of Dover. It was made a county in the 9th century by Charles the Bold of France for his son, Baldwin, and this name has been traditional for the Counts of Flanders and their descendants or representatives down to the present day, the late heir to the Belgian throne having borne the name. Readers of Norman history will remember the murder of William Longsword by Count Arnulf of Flanders. In later times it belonged to Spain and Austria, and later to Austria alone, till part was taken by France, and formed into what is now known as French Flanders, and part became Dutch and received the name of Zeeland. Besides French Flanders, which is more fitly dealt with under the head of France, there are the two Belgian provinces of East and West Flanders. Of these East Flanders has Holland on the N., the provinces of Antwerp and Brabant on the E., Hainault on the S., and West Flanders on the W. It is 34 miles long by 32 miles wide, and contains 1,157 square miles, being situated in the basin of the Schelde, and having a flat surface of a mixed sandy and clayey formation. The Pays de Waes is now noted for the high degree of cultivation it has been brought into, though till comparatively lately much of it was a sandy swamp, owing to the inundation of the Schelde which was brought about for strategic purposes. Much of the land on each side of the river can be laid under water, if necessary, in the course of a single tide. The land produces much wheat and flax, the latter crop making itself disagreeably apparent to the nostrils of anyone walking through the district bordering on the Schelde in late summer. There are abundance of horses and cattle, and much dairy produce. Wool, cotton, and flax are worked up, and flax, hops, and oil are exported. There is little wood except that planted by the roadsides, and this is

chiefly soft wood, such as willow, which is largely employed for sabot-making. There are tanneries, breweries, and distilleries. The principal towns are Ghent, Alost, Termonde, St. Nicholas, and Eccloos. West Flanders has on the N. and N.W. the German Ocean, on the S. and S.W. France, on the S.E. Hainault, on the E. East Flanders, and on the N.E. Holland. It is 54 miles long by 48 miles wide, and contains 1,248 square miles. It is generally flat, but there are some sandy hills, and dunes line the coast. Part of it is in the basin of the Schelde and the Lys, and part in that of the German Ocean, into which several small streams flow, one of the chief being the Yperlee. The soil is naturally poor and sandy, but has been brought into high cultivation. There is also much moorland, and the cattle, poultry, game, and fish are abundant. The chief products are flax, oil seeds, barley, hops, madder, tobacco, and chicory. Excellent linen is manufactured, and a good deal of lace is made. There are also breweries, tanneries, distilleries, and dye, soap, oil, and sugar works. The principal towns are Bruges, Courtrai, Ypres, Dixmude, and Ostend (Oostend). The Flemish language is by no means confined to Flanders, but is spoken throughout North Belgium, most of whose inhabitants are bilingual, and there is a good deal of jealousy between the Walloon and Flemish parts of the country. The Flemish of Antwerp differs in many points from that of Ostend, and it shades off into Dutch as the Dutch frontier is approached.

Flandrin, JEAN HIPPOLYTE (1809-1864), a French painter, was born at Lyons. His father was an artist, who had somehow missed his mark and had devoted himself to miniature-painting. His son, Hippolyte, came to Paris in 1829, and entered the studio of Ingres. In 1832 his gaining the Grand Prix de Rome by his picture *The Recognition of Theseus by his Father* did much towards smoothing his way; and he sent several good pictures home from Rome, one of the most notable of which was *St. Clair Healing the Blind*. He returned to Paris in 1838, and was employed to ornament a chapel in the church of St. Severin. He did much decorative and monumental work, and painted many portraits. In 1863 the state of his health compelled him to return to Italy, and he died in Rome.

Flank (*side*), in fortification, is the part of a bastion which extends from the face to the curtain, commanding and defending the latter as far as the next bastion. The flank of an army is properly the right or left wing, but may be used of any of its divisions. *Flank company* is the company posted on the extreme right or left of a battalion. "To flank" a position is to guard it with field-works; the word is also used of detaching troops for the purpose of defending one's own flank or attacking that of the enemy. *Flanking parties* are cavalry or infantry thrown out to reconnoitre or to protect a column while marching.

Flannel, a woollen material. It is manufactured by first of all scouring and "devilling" the wool, which is then carded, spun, woven, and fulled. The best

British flannels are the Welsh, which are made from the short staple wool of the native mountain sheep. Their manufacture is carried on extensively at Newtown and Llanidloes in Montgomeryshire. Next in quality are the Lancashire flannels, in the making of which the wool of a variety of the Sussex breed is much employed. The chief seat of the Lancashire manufacture is Rochdale. At Barnsley and other places in Yorkshire, blankets are manufactured from wool of coarse staple imported from Mysore in India. Large quantities of flannel are exported from England, especially to Australia and British North America. The industry is now well established in the United States, where the flannels are made of closely twisted yarn, and are less fulled than the English.

Flat. 1. In *Music*, is the sign \flat which lowers the note to which it is prefixed by one semitone. The double flat $\flat\flat$ lowers the note it precedes by two semitones. 2. In *Building*, a storey or floor of a house, used especially of tenement houses, in which each storey is inhabited by a separate family, all being approached by a common house door and staircase. This method of joint occupation, much in vogue on the Continent and in America, has recently become common in London, both among the well-to-do and the poor.

Flat Fishes (*Pleuronectidae*), an important family of Anacanthinous food-fishes with thirty-four genera and about 200 species from all seas except those of the highest latitudes. They are most numerous in the tropics, but the largest species are from the temperate zone. The young are symmetrical with the eyes in the normal position, and swim vertically in the open sea. The adult forms are ground fishes, markedly unsymmetrical, having the body greatly compressed from side to side, with the eyes on the upper surface, which may be the right or left, and swimming horizontally with an undulating motion. How the change in the position of the eyes is effected is uncertain. The colour of the upper side assimilates with the ground on which they lie concealed; the under surface is generally colourless. The dorsal and anal fin usually extend the whole length of the body without division. The type-genus *Pleuronectes*, from the north temperate zone, has 23 species. The most important British flat-fishes are the brill, dab, flounder, plaice, sole, and turbot (all which see).

Flatheads (SALISH, SELISH), a group of Columbian Indians, whose domain formerly extended from the Cascade Range eastwards to the Rocky Mountains. By some ethnologists they are regarded as a branch of the Athabaskan family, while others consider them an independent race speaking various dialects of a stock language. The Flatheads proper—that is, the *Têtes-Plats* of the early Franco-Canadian *voyageurs*—dwelt originally on the Flathead and Clarke affluents of the Columbia river, but are now mostly settled in the Flathead Agency, Montana. Many of the other members of the group are still known by the names given them by the Canadian pioneers, who had established trading relations with these Indians

long before the Anglo-Americans reached the Pacific slope. Such are the Pend' Oreilles, Nez-Percés, and Cœurs d'Alène, though the ethnical and linguistic relations of these and other so-called Flathead tribes are still far from being clearly established. The term Flathead, given to the chief tribe from the practice of manipulating the skull in infancy, is equally and sometimes even more characteristic of all the other Salish tribes, and notably of the Chinooks of the Lower Columbia. Another common trait is the great love of ornaments inserted in the lobes of the ear, in the nostrils and lips. The Flatheads worship the sun, to whom they formerly made offerings of human victims, for which in later times were substituted slices of flesh voluntarily cut from their breasts by the chief's sons or the bravest women of the tribe.

Flatulence, the condition in which the stomach or bowels become unnaturally distended by "flatus" or "wind." The evolution of gas is attributable to fermentation processes brought about by diseased conditions of the mucous membrane and abnormal constitution of the digestive juices. [INDIGESTION.]

Flaubert, GUSTAVE (1821-1880), a French novelist, was born at Rouen. He was the son of a physician, and inherited a small fortune, which enabled him to follow his own inclinations as to his calling in life. After some hesitation he decided upon literature, and at first essayed poetry, but finally fixed upon prose as the most fitting vehicle for expressing his sentiments. It is said that for a time he suffered from some obscure brain disease, which may not have been without its effect in colouring his thoughts and his methods. The novel which made the greatest impression upon his contemporaries was *Madame Bovary*. This displays all the characteristics of his style. A purist in language to a degree that made his writing and revision a formidable labour, he also showed a minuteness of detail and analysis that closely resembles the later "naturalistic" school, though he did not otherwise resemble them in treatment of subject. In *Madame Bovary* he paints a life of adultery in all its naked vulgarity and hideousness, and casts around it none of the glamour that some of his fellow novelists have bestowed upon it. The next most important of his novels is *Salammbô*, a story of ancient Carthage. In 1866 he was made member of the Legion of Honour. In 1862 he produced his *Education Sentimentale*, and in 1874 *Tentation de St. Antoine* and a play called *Le Candidat*. In 1877 he published *Trois Contes*, which appear to some extent to be either a reproduction, or possibly the original form, of the three novels above mentioned. *Bouvard et Pécuchet*, another sordid story of middle-class life, appeared after his death. A good edition of his works was published in 1885.

Flavaniline, a derivative of quinoline (pamido-phenyl or methyl quinoline) of composition $C_{16}H_{14}N_2$, which, together with its salts, is largely used as a dyestuff, giving a fine, clear yellow colour.

Flavel, JOHN (1627-1691), a Nonconforming minister, was born at Bromsgrove, and was educated

at Bromsgrove grammar school and at University College, Oxford. In 1650 he took orders, and was appointed curate and afterwards vicar of Deptford. In 1656 he went to Dartmouth, but in 1662 his refusal to comply with the Act of Uniformity led to his ejection. In 1687 he took a post as Nonconformist minister at Dartmouth. His published treatises and sermons fill six volumes.

Flavine, an extract of *quercitron* bark, formerly largely employed as a yellow dyestuff. Its value varied greatly with the manner in which the extract is made. It is usually obtained by boiling the bark with water and then adding sulphuric acid, which precipitates the dyestuff as a yellow powder. Various "mordants" may be employed with it, different colours resulting according to the mordant employed. With aluminium or tin mordants a fine yellow results; iron salts give a grey to black colour; and by the use of mixtures of iron and aluminium salts different shades of orange may be obtained.

Flax, the name of a plant, *Linum usitatissimum*, and of the fibre prepared from it. This annual plant, belonging to the order Linaceæ, seems to be wild in south-west Asia, to have been cultivated for 4,000 or 5,000 years in Assyria and Egypt, and to have been introduced into northern Europe by the Finns (Turanians), and farther south by the western Aryans. Previous to the coming of the latter race the closely allied perennial flax (*L. angustifolium*) was cultivated by the lake-dwellers of Switzerland and North Italy in the Stone Age, by whom its fibre was used for fishing-lines and nets. The fine linen of Egypt is on record from the time of Joseph (Genesis xli. 42). As cultivated, flax is an erect plant 20 to 40 inches high, with small, scattered, sessile, linear-lanceolate leaves and a corymbose inflorescence of bright blue flowers. The five caducous petals are three times as long as the pointed ciliate sepals; and the round capsular fruit or "boll" formed by five united carpels, though five-chambered, is partially divided by ingrowing midribs or dorsal dissepiments into ten one-seeded divisions. The seeds, which, owing to their mucilaginous testa and oily embryo, are, under the name of linseed (q.v.), scarcely less valuable than the fibre, are flat, oval, and shining, generally dark-brown, but sometimes lighter or redder. Among Western nations flax had no rival as a vegetable fibre until the rapid rise of cotton in the commerce of the end of the 18th century. Four-sevenths of the entire acreage now under cultivation for flax is in Russia, mainly in the north, and it produces fully one-half of the entire flax product of the world. There are about 116,000 acres under flax in Ireland, and the annual home production of the United Kingdom is about 25,000 tons. Besides this we import about 100,000 tons annually, 75 per cent. from Russia, 15 per cent. from Belgium, and some from Holland and Germany. The flax of Courtrai in Belgium is, owing to its fineness, strength, and colour, the most valuable in the market. The preparation of flax consists in (1) *pulling*, the crop being never mown; (2) *rippling*, or combing off the valuable seed-vessels;

(3) *retting* or *rotting*, either by *steeping*, *watering*, or *water-retting*, i.e. by soaking in pure soft water until by a fermentative decay the bast-fibre is separated from the woody axis or "shive," or by *dew-retting*, i.e. spreading the pulled flax on grass for the same change to take place more slowly; (4) *grassing*, or bleaching; (5) *breaking* and *scutching*, or separating the shive, and (6) *heckling* or combing the fibres into parallel order fit for spinning. Hot water, at a temperature of from 75° to 95° F., is sometimes employed for a more rapid retting. The coarser broken fibres removed in scutching are termed "codilla," the finer refuse from heckling is "tow." New Zealand flax is the valuable fibre obtained from the sword-shaped leaves of *Phormium tenax*, an arborescent liliaceous plant introduced in 1822 and planted unsuccessfully in Ireland but successfully in the Orkneys. The demand for this fibre, now classed commercially as hemp (q.v.), exceeds the supply, and it sells at £17 to £22 per ton for rope-making, the refuse being used as a paper material. [LINEN, LINSEED.]

Flaxman, JOHN (1755-1826), an English sculptor, was born at York. His father was a seller of plaster figures, and the lad, his son, used to copy the casts in clay. Showing a decided talent in this direction, he was sent in 1770 as a student to the Royal Academy, and in 1787 he began a seven years' residence in Italy, where he illustrated Homer (published in London, 1805), Dante (published 1806), and Æschylus. He copied much from Greek vases, but while he hit off to perfection the Greek classic style he was able to give life and originality to his works. In 1794 he returned to England, became A.R.A. in 1797, and R.A. in 1800. In 1810 he was appointed professor of sculpture to the Royal Academy, and his *Lectures* were published in 1829. His works are numerous, and many of them well-known. Among them are a monument to Lord Mansfield in Westminster Abbey, a relief of the poet Collins at Chichester, a statue of Lord Howe at St. Paul's, a statue of Sir Joshua Reynolds, and many other statues and groups.

Fleas, an order of insects once included as a subdivision of the Flies or Diptera, but now separated as the order Aphaniptera. The main characters which distinguish the Fleas from the Flies are that the wings are either absent or are rudimentary, occurring only as scales, and that locomotion is effected by jumping. The typical family is that of the *Pulicidæ*, including the Common Flea (*Pulex irritans*). The American Sand Flea (*Sarcophylla penetrans*) bores into the sole of the foot, and there expands considerably by the growth of the eggs. This is the most serious pest belonging to the order.

Flecknoe, RICHARD, was an English poet and dramatist, the contemporary of Dryden, who sharply satirised him in *MacFlecknoe* in 1682. This was unkind, for Flecknoe spoke well of Dryden. Not much is known of his life, except that he visited the Netherlands, was at Rome in 1654, when Andrew Marvell visited him, and that he went to Portugal, Brazil, and Constantinople, and died

about 1678. He wrote much, but published little, and his poetry was not of a high order.

Fleet. 1. The name of a brook flowing into the Thames on the N. bank, now a covered sewer, but formerly an open watercourse. Its name has been fancifully derived from the supposed quickness of its current; but, seeing that *rijet* is a Flemish word meaning ditch or watercourse, and that there are many *rijets* in the neighbourhood of Antwerp, it seems likely that the Fleet has exactly the meaning of ditch. The tautology of "Fleet Ditch" is akin to that of "Axholme Island," which means "Island island island." The Fleet Prison has played a great part in fiction. There was a prison here on the east side of Farringdon Street in the 12th century. It was burnt down by the Gordon rioters in 1780, and afterwards rebuilt, and finally abolished in 1845. The Fleet marriages of the 17th and 18th centuries became so great a trouble that they were abolished by Act of Parliament in 1754. The noted old law book, *Fleta*, is said to have been written by one confined in the Fleet Prison.

2. A number of warships, operating together or in unison, under a single commander-in-chief. A fleet is a larger body than a squadron, and includes, as a minimum, six battleships, with cruisers, etc., in proportion. Fleets are divided into divisions and also into subdivisions, each of which may have a flag-officer in command. The ancient division of a fleet was into three squadrons, the red, the white, and the blue, the squadrons being split up into divisions. "Fleet," as a prefix indicative of rank, is applied in the British navy to those engineers immediately above staff-engineers; to those surgeons immediately above staff-surgeons; and to those paymasters immediately above staff-paymasters. A "master of the fleet" is an officer occasionally appointed to superintend the general navigation, anchoring, or weighing of a large fleet. A "captain of the fleet," or "first captain," is an officer, either rear-admiral or captain, occasionally appointed to act as chief of staff to a commander-in-chief. To "fleet" a tackle is to overhaul it so as to bring into action such mechanical force as may be intended to be employed.

Flegel, EDUARD ROBERT (1855-1886), a German explorer, was born of German parents at Wilna, in Russia. He formed the idea of winning the trade in the Niger district for Germany, and he ascended the river in 1879 and 1880, and in 1883 he discovered the sources of the Benue. He then visited Europe, and returned to Africa in 1886 with a commission to explore the country between the Cameroons and the sources of the Benue, and intended to go to the Congo, but was stopped by death.

Fleischer, HEINRICH LEBERRECHT (1801-1888), a German Orientalist, was born at Schandau in Saxony. He studied theology and Oriental languages at Leipzig, and in 1828 and the following years was employed to catalogue the Oriental MSS. in the royal library at Dresden. In 1836 he became Professor of Oriental Languages at Leipzig, and he edited many books and MSS., among them being *Historia Muslimica, The Thousand and One Nights*, and a *Commentary on the Koran*.

Fleming, JOHN, D.D. (1785-1857), a British naturalist, was born near Linlithgow, and was ordained pastor to Bressay in Zetland. His *Report on the Economical Mineralogy of Orkney and Zetland* attracted much notice, as did in 1822 his *Philosophy of Zoology*, and in 1828 *British Animals*. In 1834 he was appointed Professor of Natural Philosophy in King's College, Aberdeen, and in 1845 to a chair of Natural Science at Edinburgh. He wrote zoological articles for the *Encyclopædia Britannica* and other works.

Flensburg, a Prussian town of Schleswig-Holstein, and one of the most important towns of the district. It is situated on a fjord of the same name, about 20 miles N.E. of Schleswig. It possesses tobacco, soap, and rice manufactures, foundries, breweries, distilleries, and sugar refineries, palm-oil mills, and steam bakeries; and it has a considerable West Indian trade. The town, with the rest of the duchy, became Prussian in 1866.

Fletcher, ANDREW (1653-1716), a notable Scottish politician, was the son of Sir Robert Fletcher, of Saltoun. After much foreign travel he returned to Scotland, and represented Midlothian in the Scottish Parliament. Owing to his opposition to the Court party he found it advisable to leave the country, and went to Holland, and was outlawed on his refusal to appear before the Council. In the reign of James II. he returned under the Act of Indulgence, of which, however, he disapproved on principle as being granted by the king's own prerogative and not by Parliament. In 1683 he was in England, joining in measures against James II., and in 1685 he took part in Monmouth's rising, but, luckily perhaps for himself, was dismissed in consequence of killing another of the Duke's adherents in a duel. He then went to Spain, and afterwards to Hungary, where he fought against the Turks. He then went again to the Netherlands, and in 1688 came over with William III., and got back his forfeited estates, and was a member of the Convention for settling the affairs of Scotland. In Queen Anne's reign he was active against the exercise of the royal prerogative and in measures for settling the demise of the Crown, and he was a strong opponent of the Union of England and Scotland. He wrote, in 1696, a *Discourse on Militias*, in which he advocated universal military training; and he left two discourses on the affairs of Scotland. He was author, too, of a proposal that beggars should be made slaves, under the name of servants, and should be alienable.

Fletcher, GILES (1588-1623), son of a Giles Fletcher who was also a poet and sometime ambassador to Russia, was born in London, and educated at Westminster and at Trinity College, Cambridge. He was afterwards rector of Aldington in Suffolk, and is spoken of by a contemporary as being thrown away upon his boorish parishioners. His chief work, *Christ's Victory*, was published in 1610, and written while he was at Trinity. He wrote also a prose tract, *Reward of the Faithfull*, etc.

Fletcher, JOHN. [BEAUMONT AND FLETCHER.]

Fletcher, PHINEAS, brother of Giles, but whether older or younger is unknown (c. 1582-c. 1650), was an English poet, chiefly known by his *Purple Island* and his *Piscatory Eclogues*. The former is a description of man after the style of Spenser, and founded upon a part of the *Fairy Queen*. Some of it is rather anatomy than poetry, but in the part that describes the mental composition of man are many fine passages and much bold imagery. The *Piscatory Eclogues* also have much merit. Milton is said to have borrowed some ideas from Fletcher.

Fleur-de-lis, formerly the national emblem of France. The word means "flower of the lily," and the three tufts united by a band have as much resemblance to lilies as to anything else. Some, however, suppose the iris to be intended—an explanation which is perhaps favoured by the occurrence of the English "flower-de-luce" as the name of a kind of flag. Others see in the fleur-de-lis the head of an ancient spear called *francisque*. The English used to see a resemblance to a frog, whence the connection of frogs with Frenchmen. But it is now known to have existed as an emblem of royalty or nobility among various nations at different epochs, and ornaments of this kind are said to have been found carved on the sphinxes. The usual form of the French device is three fleur-de-lis on a single coat.

Fleury, ANDRÉ HERCULE DE (1653-1743), a French cardinal and prime minister, was born in Languedoc, and was educated at the Jesuit College of Clermont. He then went to Paris to study philosophy, and such was his progress that he became successively a canon of Montpellier, a doctor of the Sorbonne, and almoner to the queen and then to the king. Louis XIV. made him Bishop of Fréjus and tutor of the prince afterwards Louis XV. After the death of the king he managed to retain the favour of the regent, and in 1726 he became chief minister, and was made cardinal. He piloted France safely through a war with Germany, which resulted in the acquisition of Lorraine by France. A later war, which he did not live through, was unsuccessful.

Fleury, CLAUDE (1630-1723), a French man of letters, was born at Paris, and educated at the Jesuit College at Clermont. He became a lawyer, but abandoned the law for the Church. In 1672 he was appointed tutor to the princes of Conti, and later became the tutor of an illegitimate son of Louis XIV., and was appointed to aid Fénélon in the education of the young Duke of Burgundy. [FÉNÉLON.] He was made abbot of a Cistercian convent at Loc-Dieu, and afterwards prior of the convent of Argenteuil. He became a member of the Academy in 1696, and, owing to the moderate attitude which he adopted in the ecclesiastical controversy of the time, he was appointed confessor to Louis XV. He wrote a good deal, among his works being an *Histoire du Droit Français, Mœurs des Israélites, Mœurs des Chrétiens*, and *Histoire Ecclésiastique*.

Flies. [DIPTERA.]

Flinders, MATTHEW, naval officer and navigator, was born in 1774 at Donington, Lincolnshire,

entered the navy in 1790, and fought in the *Bellerophon* on the Glorious First of June, 1794. In 1795, with some of the ship's company of the *Reliance*, he left Port Jackson, and explored the whole coast to the southward, discovering Bass Strait. In 1797 he was made a lieutenant. In 1801 he obtained command of a larger expedition to explore the coasts of Australia in the *Investigator*. He executed the work most successfully, but on his return was captured by the French, and was for six years their prisoner. In 1810, upon regaining England, he was most deservedly made a post-captain. Four years later he published *A Voyage to Terra Australis*, and in the same year he died.

Flint (or FLINTSHIRE). 1. A maritime county of North Wales, consisting of two parts, one having the Dee on the E., the Irish Sea on the N., and Denbigh on the S. and W.; the other, separated by Denbigh and lying 6 miles to the S.E., has Cheshire on the N.E. and Shropshire on the other sides. It is the smallest of the Welsh counties, but is very populous. The larger part is 27 miles long by 8 miles in width, and the smaller 8 miles long by 5 miles wide; and the two together contain 169,162 acres. A range of not very high hills crosses the county from S.W. to N.E. There are fertile and well-watered valleys, and part of the Clwyd is in the county. The coast is low, and there are very wide stretches of sand, the tide going out a great way, and returning with a rapidity that makes the sands dangerous to strangers. Wheat and oats are the chief crops. There is a breed of small cattle that give excellent milk, and there is much dairy produce. The lead of the county is considered the best in the kingdom, and coal, copper, and manganese are also worked. Holywell and Mold are the chief smelting places. There are 14 miles of works, and ship-building yards along the coast. The county returns one member to Parliament. The Chester and Holyhead Railway passes through the county, following the coast. Pop. (1901), 81,725.

2. A parliamentary and municipal borough, market-town, and seaport of Flintshire, North Wales, lying to the S.W. of the estuary of the Dee, 13 miles S.W. of Liverpool. It is built mostly of brick, and is at the foot of a hill. There are a modern Gothic church, a guildhall, several chapels, a prison, and a library. There are large alkali works, and lead and coal mines in the neighbourhood, and much copper. The old castle—now in ruins—was built by Edward I., and became the prison of his grandson, Richard II. The town joins with others to send one member to Parliament. There is a station here on the Chester and Holyhead Railway. Pop. (1901), 4,624.

Flint, a form of silica (SiO₂), almost pure, occurring in thin beds ("tabular flint"), or more commonly in layers of irregularly-shaped nodules or "flints," in the Upper and Middle Chalk. The phthanites of the Carboniferous limestones, and the cherts of the Purbeck and other beds, closely resemble flint; but are seldom as pure and have generally a splintery fracture instead of the shell-like or "conchoidal" mode of breaking characteristic of true flint. Flint consists of a mixture

of crystalline and insoluble with non-crystalline and soluble silica: the exterior of the nodules is generally less dense and white; the interior horn-like, grey or black and homogeneous, or sometimes banded like an agate; and the centre often hollow and lined with minute crystals of quartz. They frequently have fossils of various kinds imbedded in them, sea-urchins, brachiopods, bivalves, etc., and may have their form entirely determined by branching sponges now represented by a mass of chalk in their central cavity. The microscope also reveals numerous spicules of sponges throughout the flint. No theory of flint formation is altogether satisfactory; but apparently the silica was removed in the first instance from sea-water by the action of living sponges and other organisms, and has subsequently been to some extent aggregated by a purely chemical process of concretion and replacement. It is noticeable that there is less diffused silica in the chalk nearest to the nodules, and that tabular flint occurs in vertical joints (q.v.) as well as along the horizontal beds of the chalk. These facts show aggregation subsequent to the deposition of the chalk. Flints are used for building, are broken up for road-metal, and are powdered and calcined for the manufacture of glass and pottery. In prehistoric times they formed the main material of all weapons and implements over most of Europe, knives, axes, hammers, hide-scrapers, and light-strikers. The earliest human period or Stone Age is subdivided into two, the Palæolithic and Neolithic, distinguished by the flints being merely chipped or being also polished. Though no longer used with iron-pyrites (q.v.), and but seldom with steel, for striking a light, large numbers of flints are still chipped or "knapped" into gun-flints in Suffolk for use by African tribes, who prefer them to percussion caps.

Flint Glass. [GLASS.]

Flint Implements, a comprehensive term for the tools and weapons of primitive man, fashioned from flint, before the knowledge of metals. In some cases, however, the use of such implements lingered on as a ceremonial observance, notably for circumcision among the Semites (Exod. iv. 25; Josh. v. 2, margin), for embalming among the Egyptians (Herod. ii. 86), and for the emasculation of the priests of Cybele among the Romans (Catullus, *Carm.* lxiii.; Ovid, *Fasti* iv. 223-296). The list might be greatly extended, and implements similar to those of our remote ancestors are in common use among many tribes of low culture at the present day. Dr. Tylor distinguishes these implements, according as they are merely chipped or ground and polished after chipping as belonging respectively to the Unground or Ground Stone Age— indefinite periods to which Sir John Lubbock has applied the epithets Palæolithic (with Archæolithic as an alternative, but this never came into general use) and Neolithic. The former are generally found in river drifts and caves, and associated with the remains of extinct animals, as the mammoth and woolly rhinoceros, or of the hyena, no longer found in Europe. The latter are met with in surface soil, burial mounds, and lake dwellings, often with the

bones of the ox and other domestic animals. Palæolithic implements are generalised—that is, they may serve for many purposes, and are of three fairly distinct types: (1) oval, with sharp edges; (2) long and pointed; and (3) tongue-shaped; while the later ones show distinct specialisation, and the uses of most of them are apparent at once. For these a variety of epithets have been employed by various authorities chiefly with reference to their shape. There was a great find at Kent's Hole, near Torquay, in 1834; then came the discoveries of Boucher de Perthes of Abbeville, of Dr. Rigollot in the drift of St. Acheul, near Amiens, and the visits of English geologists and anthropologists to the valley of the Somme in 1858 and 1859. Since then the investigations that have been carried on have resulted in the discovery of a vast number of these implements, and there is scarcely a museum in the country that has not specimens, very often found in the neighbourhood. There was a prehistoric manufactory of flint implements near Brandon, in Suffolk, and the making of gun-flints is still the chief industry of the town.

Flodden, a village in Northumberland, 5 miles S.E. of Coldstream, chiefly notable as having been the scene of the noted battle in 1513, when the Earl of Surrey completely destroyed James IV. of Scotland and his army. Scott in *Marmion*, Aytoun in his *Edinburgh after Flodden*, and Lady Lindsay's *Flowers of the Forest* have commemorated the battle.

Flogging. [WHIPPING.]

Flood, HENRY (1732-1791), an Irish politician, was educated at Trinity College, Dublin, and at Christ Church. In 1759 he was returned to the Irish Parliament for Kilkenny, and in 1761 for Callan. He was leader of the popular party, and distinguished himself as an orator and duellist. From 1775 to 1781 he was Vice-Treasurer of Ireland. He considered Grattan much too mild a politician. In 1783 he represented Winchester in the English Parliament, and Seaford in 1785, but he did not make much mark in the English House. His *Life and Correspondence* have been published.

Floor Cloth. All the materials used for covering floors are now included under this title. The most important being the old-fashioned oil-cloth and the newly-invented linoleum. *Oil-cloth*, in the course of its manufacture, goes through the following processes:—Coarse canvas made of jute or flax-tow is woven in large pieces; these are then cut into smaller sections, and one of them—perhaps 25 yards long and 8 yards wide—is placed on an upright frame and stretched by means of screws. It is then "primed" with size, and, when dry, scooped with pumice, after which it is ready for painting, as these operations render it impervious to the injurious acids which escape during the oxidation of the linseed oil of which the paint is composed. The paint—usually yellow ochre—is, first of all, applied to the back with a steel trowel, and when it is dry—which, unless artificial means be used, may not be for a fortnight—another coat is laid on. The front is painted five or six times, and pumiced

once or twice before receiving a new coat. A final coat is added with a brush, which gives the ground shade, called the *brush colour*. The next stage is the printing, which is effected by means of wood-blocks, each colour in the pattern being stamped on the canvas by means of a separate block. They are usually made of pear-tree wood, and are about 18 inches square. Steel tools are commonly used to engrave the pattern on the block, but this is now sometimes done with heated iron punches. The floor-cloth is laid beside the printers on a table with a padding of flannel or felt; on another table are placed the colours, on which each printer in turn dabs his block and then forces it down on the floor-cloth by means of a small screw press. The printing is now sometimes done by machinery, the process in this case being an imitation of hand-printing.

Linoleum consists of canvas backed with pigment and size, the wearing surface of which is covered with a mixture of pulverised cork, oxidised linseed-oil, common resin, and kauri resin. The chief element is the pulverised cork, for which waste cork-cuttings are used; these are reduced to fragments about as large as a pea by means of a series of steel discs, furnished with teeth which revolve on a shaft against steel plates with serrated ends; they are then ground into powder by millstones. The oxidised linseed-oil is obtained by setting long pieces of calico, called "scrim," in an upright position, and then "flooding" them with boiled oil, which spreads over their surface in thin films. This is continued for 6 or 8 weeks, at the end of which time the oil has become about half an inch thick. The scrim and the films together form a "skin," but the oxidation of the oil results in the decomposition of the scrim. The oil is now mixed with the resin in the proportion of from 4 to 8 cwt. of oil to 1 cwt. of each of the two kinds. For this purpose a pan is used which has an outer jacket filled with steam; it is covered with an air-tight lid, and within the pan and at a valve at the bottom there are stirrers. The common resin is placed first in the pan; when it has melted, the kauri and oil are added, the steam being shut off as soon as the mixture becomes warm, as the oxidation of the substances furnishes the requisite amount of heat. When the "cement" has been formed, the valve is opened, and it descends between grinding rollers. It is then allowed to cool, but heated again before being mixed with the cork. The next step is to fuse the ingredients more completely together by passing them into a cylinder, which has a steam jacket, and contains fixed and revolving knives. The mixture is then formed into a sheet through the action of two rollers, one of which is kept cool, while the other is heated with steam. This sheet is broken into small pieces, which are forced into the canvas by means of steam-heated rollers of cast iron. A backing of size and pigment is then given to the canvas, after which it only requires to be printed and cut into separate pieces.

Floors are ordinarily made of wood, especially in the upper storeys of private houses. In large buildings fireproof floors constructed of bricks,

with iron girders, are now common. For basement-floors tiles, cement, and flagstones are often used, but here, too, wood is a common material. *Single-joisted* floors are made by laying planks close together over a series of beams termed joists, which are usually about 10 inches deep and about 3 inches broad. The distance between the joists varies from 12 to 16 inches from centre to centre. When they are more than 10 feet long they require to be strutted, to prevent their falling out of position. The most effectual kind of strutting is the "herring-bone," which consists of pieces of wood nailed one across the other between the joists. Beneath the joists are the laths, to which is attached the ceiling of the room below. The "pugging" or "deafening"—cement or coarse plaster which prevents the transmission of sound—is placed between the flooring and the ceiling. In *double-joisted* floors there are two sets of joists, separated by larger beams called *binders* or *binding-joists*: the upper row are called *bridging-joists*, because they bridge over the space between the binders: this is termed a bay, and has a width of about 6 feet. The *framed floor* has both binding and bridging-joists, but the main support is here given by the *girders*, which are either entirely of wood or iron, or of iron plated with wood. The binding-joists are attached to the girders by means of *tusk-tenon* joints, and to these the bridging-joists are notched. The methods of jointing the flooring-boards vary: in the *grooved-and-tongued* joint a tongue at the edge of one board is inserted in a groove in that next it. The flooring-boards are usually from 4 to 6 inches broad, and about 1½ inch thick. Where floors are made of soft wood, as in England, it is common to stain and varnish the surface for a distance of about 2½ feet round the walls.

Flora, a Roman goddess of flowers and of spring. Her worship was adopted at a very early period of Rome's history, and is hardly extinct yet, since there can be little doubt that the dedication of the month of May to Our Lady, and the practice that still prevails in some parts of England on the 1st of May for children to carry bowers of flowers containing a female figure, had its origin in the worship of Flora. Her feast—called *Floralia*—was kept from April 28 to May 1.

Florence (*Firenze*; *Florentia Tuscorum*), a North Italian town, capital of a province of the same name, 143 miles N.W. of Rome, and 50 miles N.E. of Leghorn. It is surrounded by hills, and it has extensive suburbs and villas upon the heights. The Arno, flowing through the city, divides it into two parts, most being to the N. The river is from 100 to 150 yards wide, and is crossed by four bridges—the marble Ponte della Santa Trinita (which has three arches and is adorned with statues), Ponte Vecchio (which is lined with shops and has a covered way), and two suspension bridges. On both sides of the river are quays called *Lung'Arno*, and, though the city walls have been removed, the towers of the gates still exist. The streets are narrow, but clean and well-paved. There are many piazzas, the chief of them being Piazza della Signoria, with its marble fountain and statue of Cosmo I., and that of Santa

Croce. But the great feature of Florence is the Duomo, or Cathedral, built 1298-1474, and completed as to the façade in 1387. This is said to possess the largest dome in the world. It was designed by Brunelleschi. It stands in the great square, and is built of brick, which is cased inside and out by mosaics, the outside casing consisting of black and white marble. The campanile, or bell-tower, 293 feet high, is by Giotto, and is also encased in marbles, and ornamented in relief by illustrations of the progress of civilisation. The octagonal church of San Giovanni has very beautiful bronze gates. In the church of Santa Croce are the tombs of Michael Angelo, Galileo, Machiavelli, and Alfieri, and in the piazza is a monument to Dante, erected in 1865. There is a famous gallery of painting and statuary in the Uffizi; and the Pitti Palace, once the residence of the King of Italy, has 500 examples of the great masters, and attached to it are large gardens. The Bargello, formerly a prison, is now a national museum, and the Medicean Library ranks next to the Vatican for its collection of MSS. The Magliabechian Library has a fine collection of books and MSS., and is the national library. There are two other public libraries. Of other palaces the Palazzo Vecchio was the residence of Cosmo I. Other points of interest at Florence are the Accademia della Crusca, which is the literary headquarters of the country, the University, which has a good natural history collection—many of the subjects in which are modelled in wax—the Observatory, and the Botanic Garden. There is a good railway connection with the other chief towns, and there is considerable trade in silk, woollens, straw-hats, porcelain, mosaics, and works of art. The silkworm is reared in the neighbourhood. Florence was originally a colony of Roman soldiers, but after the rise of the Empire little was heard of it till about the 12th century, when it became the resort of bankers, jewellers, and goldsmiths. Its full tide of glory set in when it became almost the home of the Renaissance, and when in 1434 Cosmo de Medici was the reigning merchant-prince. After the fall of the Republic, one member or another of the Medici family ruled as Dukes till 1737, when it became part of Tuscany, to be merged later in the kingdom of Italy. From 1865 to 1871 it was the capital of the new kingdom. Among the many names that have made Florence illustrious may be mentioned Dante, Petrarch, Boccaccio, Lorenzo the Magnificent, Michael Angelo, Leonardo da Vinci, Benvenuto Cellini, and Savonarola.

Florentine Experiment, THE, was to determine whether water was compressible to any appreciable extent. It was performed in Florence by Torricelli, in the year 1661, and from the result was deduced the fact that water is incompressible. Later experiment has shown this conclusion to be incorrect, for water does admit of a certain amount of compression, and instruments have been designed to measure this amount. The Florentine experiment consisted in filling a hollow sphere of gold with water, plugging up the orifice by means of which the filling was effected, and then submitting the sphere to great external pressure. It was a known fact that of all

solids with given surface area the sphere possesses the greatest volume, and it was therefore recognised that if the golden sphere should undergo any deformation into an ellipsoidal form, its bulk and, therefore, that of the enclosed water would be diminished. The actual result was that rather than submit to any appreciable diminution, the liquid forced its way through the pores of the metal, and appeared as dew on the outside. Francis Bacon had performed the same experiment with a leaden sphere some twenty years earlier.

Flores. (1) The westernmost of the Azores, about 30 miles in length by 9 miles wide, and containing an extinct crater, now a lake. (2) An island of the Indian Archipelago, E. of Java, being 100 miles long by 50 miles wide. It is mountainous, and has volcanic peaks, reaching a height of 7,000 feet. Some sandalwood is exported. The island gives its name to a strait and to a sea. (3) An island of the South Pacific, opposite Vancouver, 15 miles long and 2 to 6 miles broad.

Florida, a peninsula and one of the United States of North America, having Alabama and Georgia on the N., the Gulf of Mexico on the W., the Atlantic on the E., and the Gulf of Florida on the S. It is 380 miles long, with an average breadth of 80 miles, and contains 59,268 square miles. The surface is for the most part level, and in the S. consists of marsh and swamp, the coast being flat and fringed with islands of sand separated from the mainland by a succession of shallow lagoons. There are many lakes, some of them very deep, the larger of which average from 8 to 15 miles long. One of them disappeared in 1892, through openings at the bottom. The most important rivers are Apalachicola and the Suwanee, flowing into the Gulf of Mexico, and the St. John's and the Ockloconce flowing into the Atlantic, but the navigation is much impeded by sand bars at the mouths. There are many islands, the most notable being the group called the Florida Keys, lying about 100 miles S.W. There are some large bays and good harbours, mostly on the E. coast, the most important of them being Chatham Bay and Charlotte Harbour. The land along the rivercourses is very fertile, and grows tropical plants and fruits in profusion. Cotton, olives, pumpkins, and melons flourish, and sugar, maize, tobacco, and potatoes are largely cultivated. One great speciality of late years is the cultivation of the orange, the groves of which have now become a great feature of the country and occupy the attention of many colonists. Cattle-rearing also is largely carried on. Coal and iron are almost the only minerals, though precious stones are said to have been sparingly found. Besides magnificent pine-forests, Florida has abundance of cedars, cypress, and live-oak, the last of which is exported in considerable quantities for the United States naval building-yards. Among the wild animals are the wolf, wild-cat, panther, raccoon, opossum, rabbit, squirrel, and, in the swamps, the brown bear. Birds of many kinds abound, as do fish and tortoises, and there are snakes and alligators. The state is now well served by railways, and sugar, cotton, and oranges

are exported. Among the industries are tanning, a little ship-building, lumbering, and wood-sawing; and there are manufactures of hats, leather, bricks, and waggons. The capital is Tallahassee, and there is a naval station at Pensacola. The country was discovered by Sebastian Cabot in 1497, and was visited by both Ponce de Leon and Hernando de Soto. In the 16th century some French Huguenots founded a colony, which did not prosper. In 1763 it was ceded to England in exchange for Cuba, and in 1781 the Spaniards reconquered it. It was ceded to the United States of America in 1819, and in 1845 was constituted a State.

Florin. The original gold florin was first used at Florence in the 13th century. It took its name either from the city or from a lily, which was the sign stamped on one of the faces. The florin is known in Germany as a gulden, and the modern Austrian gulden still bears the mark *Fl.* The ordinary value of the gulden was from 1s. 8d. to 1s. 10d. English. The name "florin" has only recently been introduced into England.

Florio, GIOVANNI (1552-1662), was born in London, of Italian origin, his father and mother being Waldensian refugees. In 1576 he was at Oxford as tutor to the son of the Bishop of Durham. In 1578 he published his *First Fruits*, accompanied by a collection of Italian proverbs, and a *Perfect Introduction to the Italian and English Tongues*. In 1581 he became a member of Magdalen College, and teacher of French and Italian. In 1591 appeared his *Second Fruits*, with 6,000 proverbs. In 1603 he published a translation of Montaigne's essays; and it has been supposed, though without much apparent ground, that he stood to Shakspeare as the model of Holofernes in *Love's Labour's Lost*.

Flotation. A body will float in water if its weight be not greater than the weight of the same bulk of water. If the two weights are equal, the body will float in any position below the surface; if the body is lighter than the weight of equal bulk of water, it will rise up to the surface, and be only partially submerged. It then displaces its own weight of water. Thus, ice has a density eight-ninths that of water; eight pounds of ice have the volume of nine pounds of water. This quantity of ice will in floating displace eight pounds of liquid, which occupies eight-ninths the volume of the ice. Hence ice in floating has only one-ninth of its volume out of water—i.e. above the surface level. [HYDROSTATICS.]

Flotow, FRIEDRICH FREIHERR VON (1812-1883), a German composer, born at Mecklenburg. He was intended for diplomacy, but a visit to Paris in 1827 determined him to music. His *Naufrage de la Méduse* (1839), *Stradella* (1841), and *Martha* (1847) brought him reputation. His later efforts met with no great success. From 1856 to 1863 he was intendant of the theatre at Schwerin, and he then returned to Paris.

Flotsam, or FLOATSAM, goods floating upon the sea, which belong to the Crown unless claimed by the true owners thereof within a year and a day.

In order to constitute a legal wreck, the goods must come to land. If they continue at sea, the law distinguishes them by the barbarous and uncouth appellations of *jetsam*, *flotsam*, and *ligan*. *Jetsam* is where goods are cast into the sea, and there sink and remain under water. *Flotsam* is where they continue swimming on the waves. *Ligan* is where they are sunk in the sea, but tied to a cork or buoy in order to be found again. Such goods are also the Crown's, except claimed as above. For even if they be cast overboard without any mark or buoy in order to lighten the ship, the owner is not by this act of necessity considered to have renounced his property. Much less can things *ligan* be supposed to be abandoned, since the owner has done all in his power to assert and retain his property. These three are accounted distinct things from wrecks, so that by a royal grant to anyone of wrecks, things *jetsam*, *flotsam*, and *ligan* will not pass. [JETSAM, LIGAN.]

Flounder (*Pleuronectes flesus*), called in Scotland the Fluke, a flat fish esteemed for food, common round the coasts of Britain and Northern Europe, spawning at the mouths of rivers, up which it often passes, being taken in the Thames as high as Richmond, and thriving well in ponds. It is, of course, unsymmetrical. Large specimens are about a foot long; the upper side, generally the right, is brownish or greenish-olive, with yellow spots, most vivid in the spring, and disappearing later in the year; the under surface is yellowish white, or it may be coloured like the upper surface. These fish have blunt conical teeth and small smooth scales, with tubercles at the side of the head and at the base of the dorsal and anal fins.

Flourens, MARIE JEAN PIERRE (1794-1867), a French physician and physiologist, graduated M.A. at the University of Montpellier at the age of 19. He then went to Paris, and his first writings were published in 1819. In 1821 he lectured upon sensation, and wrote several papers in physiology. In 1837 he was elected to the Chamber of Deputies, and made a member of the Legion of Honour, of which he became Grand Officer in 1839; and in 1840 he entered the Academy, and from 1846 to 1848 he was a peer of France. His writings are very numerous, and he was one of the first to establish the fact of the constant renewal of the bodily frame. His son, Gustave Flourens, also a biologist of distinction, was killed while fighting for the Paris Commune in 1871.

Flower, an axis bearing sporophylls—i.e. a branch bearing leaves specially modified for reproductive purposes. Like other shoots, its existence begins as a bud, known as a *flower-bud*, which originates generally in the axil (q.v.) of a leaf, and consisting of a growing-point with minute rounded protuberances, the future floral leaves, protected by the over-lapping bud-scales, cannot at first be distinguished from an ordinary leaf-bud. [BUD.] Subsequently, unlike an ordinary shoot, a flower seldom has the internodes between its leaves at all elongated. The axis immediately below the flower

is termed the *pedicel*, and within the flower it is commonly terminated in a conical, rounded, flattened, or discoid, or convex expansion forming the *receptacle*, *thalamus*, or *torus*. A typical flower consists of this receptacle and four kinds of *floral leaves*—viz. the *floral envelopes* or *perianth*, consisting of the *calyx* (q.v.) made up of *sepals*, and the *corolla* (q.v.), made up of *petals*, and the *essential organs* or *sporophylls*, consisting of the *stamens* known collectively as the *androeceum* and the *carpels*, collectively the *gynaeceum*. If both calyx and corolla are present, as in the buttercup, the flower is termed *complete* or *dichlamydeous*, from the Greek *chlamos*, a cloak; but if either or both series of floral envelopes be absent, the flower is *incomplete*. Incomplete flowers with one whorl of envelopes, as in the anemone, are termed *monochlamydeous*; those with no envelopes, as in the ash, *achlamydeous*. If both kinds of essential organs are present in one flower, as in the buttercup, it is *perfect*, *hermaphrodite*, *bisexual*, or *monoclinous* (from the Greek *klinē*, a couch); if either stamens or carpels be absent, the flower is *imperfect*, or *unisexual*, and *staminate* or *pistillate*, as the case may be; whilst if neither class of essential organ be present, as in the cultivated hydrangea or snowball-tree, it is *neuter*. A species is termed *diclinous* when stamens and pistils are present, but in different flowers, and *diclinous* plants are either *monœcious* (from the Greek *oikos*, a house), where, as in the hazel, oak, and birch, staminate and pistillate flowers occur on the same plant, or *diœcious*, as are the willows and poplars, when they occur on distinct plants. Where perfect and imperfect flowers occur on the same plant, as in the ash, maple, horse-chestnut, etc., it is called *polygamous*.

Some plants produce flowers which never open, remaining, as it were, as permanent buds, though producing fruit. These, as a rule, are only produced late in the flowering season. In the common violet, for instance, the sweet-scented and attractive flowers produced in spring are seldom visited by insects, though secreting honey and having other contrivances connected with their visits, and these flowers very seldom produce fruit. Later in the summer other small, inconspicuous flowers, on shorter stalks, with hardly a trace of corolla and other parts reduced in number, are produced but never open, and these seed freely. They are termed *cleistogene* or *cleistogamous* (from the Greek *kleistos*, shut), other flowers in contradistinction being *chasmogamous* (from *chasma*, I gape).

No general rule can be laid down as to the order in which the different floral organs reach maturity. The variation in this particular is most important with reference to the stamens and carpels. These either mature simultaneously—i.e. the anthers of the stamens are ready to burst and liberate the pollen when the stigmas of the carpels are sticky, in which case the flower is termed *syœcious*, as in the case of the dwarf mallow; or they mature in succession, when the flower is termed *dichogamous*. If, as is most commonly the case, the anthers mature first, the flower is *protandrous* or *proterandrous*; if the stigmas mature first, it is

protogynous or *proterogynous*. In either case of dichogamy cross-pollination (q.v.) must occur if seed is to be formed.

When the floral receptacle is elongated the leaves of the flower are commonly arranged wholly or partly in a spiral, and are indefinite in number, as in the spice-tree (*Calycanthus*) and in the white water-lily. In the latter instance the green sepals pass gradually into the white petals, the inner ones being green outside and white inside, and the petals becoming narrower graduate into the stamens, thus exemplifying the foliar nature common to all these organs. When the axis is shortened, each series of floral leaves spring from it at one level in a *whorl*. There is typically one whorl each to calyx, corolla and gynaeceum, though often two in the androeceum. The leaves in each whorl are generally *alternate* with, or *opposite* the spaces between, those of the preceding whorl, but in *Primula* the stamens are *superposed* to, or stand in front of, the petals, and in *Iris* the carpels are superposed to the stamens. The number of leaves in each whorl is typically three among Monocotyledons, and five among Dicotyledons, which is expressed by saying that the floral symmetry is *trimerous* in the former and *pentamerous* in the latter; but increase of the stamens to an indefinite number is common among Dicotyledons, as is also a reduction of the parts in each whorl to two, and in both groups a reduction in the number of carpels. Where all the parts in each floral whorl are similar in size and shape the flower can be divided by several radiating planes of symmetry, and is called *polysymmetric*; whilst where, from inequality of size or difference of form of the parts in any one whorl, the flower can only be divided by one such plane, it is *monosymmetric*. Polysymmetric flowers are often called *regular* or *actinomorphic* (star-shaped), and monosymmetric ones, having their parts in pairs, are called *zygomorphic* (yoke-shaped) or, less accurately, *irregular*. Flowers are occasionally truly irregular or *asymmetric*, not being symmetrically divisible by any plane. The primitive type or original form of flower in every large group would seem to have been polysymmetric, and most of the departures from this primitive condition are adaptations to secure cross-pollination by insects.

Almost all these modifications by which flowers depart from the typically simple condition of four or five whorls of similar, separate organs, three, five, or two, in a whorl, may be explained as due either to cohesion, adhesion, abortion, suppression, chorisis, or unequal growth. *Cohesion* (q.v.) is the union of like parts, such as sepals to sepals; *adhesion*, the union of dissimilar parts, such as stamens to petals. Nearly all cases of so-called cohesion and adhesion in the flower are really due to the *intercalary growth* of the receptacle in rings or tubes, below, in the first case, a single whorl, and, in the latter case, below two or more contiguous whorls. When, for example, in the bramble, rose or apple, sepals, petals, and stamens are all carried outwards or upwards on a receptacular disc or tube round the gynaeceum without adhering to it, they are termed *perigynous* (from the Greek *peri*, around), or, as the tube was formerly called a

calyx-tube, calycifloral. [CALYCIFLORE.] If the adhesion goes a step farther, so that the carpels are enclosed in an adherent receptacular tube, and the sepals, petals, and stamens appear to spring from the top of ovary, this ovary is termed *inferior*, the calyx *superior*, and the "insertion" of petals and stamens *epigynous* (Greek *ἐπι*, upon).

Abortion is the reduction of an organ to a mere rudiment, generally with loss of its original function, as when in *Salvia* two stamens no longer produce pollen, being in consequence known as staminodes. **Suppression** is the complete absence of a part, the typical presence of which is often only indicated by comparative anatomy or by cases of reversion, as in the absent fifth stamen in *Salvia*, the three absent in *Veronica*, or the third carpel absent in most grasses.

Actual multiplication of the number of floral whorls (*pleiotaxy*) occurs in many double flowers (q.v.); but increase in the number of parts (*pleiomery*) is largely due to *chorisis*—i.e. the splitting or branching of the floral leaves early in their development. This may be either *collateral*, when the resulting branches are side by side or in the same whorl; or *co-radial*, when they are superposed, one in front of the other, on the same radius of the flower. The stamens of the orange, for instance, though described as "polyadelphous" or coherent in several groups, are really few in number, but branched; and the "indefinite monadelphous" stamens of the mallows are due to the branching of five, which have subsequently been carried up on a receptacular tube. Cohesion, adhesion, and even chorisis will often not interfere with the polysymmetric character of the flower; but abortion, suppression, and the irregular growth of individual members in a whorl will commonly do so.

Many of the facts as to floral structure and symmetry are conveniently represented for comparative purposes in a *floral diagram* or diagrammatic ground-plan, each whorl being represented by a circle. These diagrams are either *empirical*, merely stating the facts, or *theoretical*, filling in suppressed parts in accordance with some type. Plants, belonging to one Natural Order, will commonly have identical, or nearly identical, diagrams, and diagrams may also serve to suggest even more remote relationships. Most facts expressible in diagrams and some others can also be expeditiously represented in *floral formulæ*. Various notations are in use for these formulæ using unnecessary abbreviations for sepals, petals, stamens, and carpels. Omitting these, we may take the figures before the first full stop to refer to the sepals; those between the first and second, to the petals; those between the second and third, to the stamens; and those after the third, to the carpels; round brackets () indicate cohesion; square ones [], adhesion; a line above or below the last figure shows the ovary to be inferior or superior; a dagger (†) indicates abortion; zero (0), the suppression of a whorl; plus (+), the occurrence of more than one whorl of any one kind of floral leaves; the multiplication sign (x), branching or chorisis; a waving line (˘) over a figure, spiral arrangement; ∞, an indefinite

number of parts; | before the number representing a whorl, that it is superposed on the preceding one; X, that its parts are arranged diagonally; and the signs → and ↓ before the formula, monosymmetry in the transverse or lateral plane or in the median (antero-posterior) plane respectively. Formulæ, like diagrams, may be empirical or theoretical. Thus, the formula of the flower of the lily is 3. 3. 3 + 3. (3), that of *Amaryllis*, 3. 3. 3 + 3. (3); that of *Iris*, empirically, 3. 3. 3. | (3), theoretically, 3. 3. 3 + 0. (3); that of *Orechis*, empirically, ↓ 3. 3. [1 + † 2. (3), theoretically, ↓ 3. 3. [1 + † 2 + † 3. (3)]; that of the mallows, empirically, (5). [5. (∞)]. (∞), theoretically, (5). [5. (5 × ∞)]. (∞); and that of the Cruciferae (q.v.), 2 + 2. X 4. 2 + 2 × 2. (2). [ÆSTIVATION, CALYX, CARPEL, COLOURS, COROLLA, POLLINATION, STAMEN, VEGETABLE.]

Flower, SIR WILLIAM HENRY, zoologist, was born in 1831 at Stratford-on-Avon. He paid much attention to zoology, and took part in the Crimean campaign as assistant-surgeon. He was afterwards appointed demonstrator in anatomy at the Middlesex Hospital. In 1861 he became conservator of the Hunterian Museum, in 1869 Hunterian Professor of Comparative Anatomy and Physiology, and in 1884 director of the Natural History Department of the British Museum, a post which he resigned in 1898. He wrote much upon anatomy, osteology, zoology, and anthropology. He died in 1899.

Flowers, ARTIFICIAL. The manufacture of artificial flowers is carried on by various races, both civilised and savage, and many different materials are employed in their construction. Uapaper is in use among the Chinese, while the natives of the Bahama Islands are skilful in making flowers out of shells. In Europe the chief seats of the industry are in France, England, and the Netherlands. Artificial flowers are chiefly used for decorating ladies' hats, etc.; the methods employed in their manufacture have much improved of late years, and the industry now gives employment to a large number of persons, many of whom are women and children. The flowers are generally made of cambric, fine calico, crape, muslin, satin, and similar materials. The ordinary process is as follows:—The pistil and stamens are the first part finished; they consist of pieces of sewing silk, the tips of which are moistened with gum and then powdered with flour, tinted yellow, to give the appearance of pollen. These are attached to a piece of wire, and, after the petals and sepals have been placed round them, the whole is securely bound together with fine thread or silk. The stalk is formed by the addition of other wires, also placed within the thread, and surrounded by green tissue paper. To these the leaves are fastened by pieces of fine wire, the lower extremities of which are hidden by the tissue paper. The petals, sepals, and leaves are produced by means of stamping machines or punches, called "irons," which differ according to the size and form required. They are then subjected to the process called "goffering," which consists in giving them a

rounded or curled form by means of an iron ball, which is heated and pressed down on the petal or leaf, the latter being previously laid on a cushion. The ribs and veins of the leaves are produced by other kinds of goffering-irons. The variety in the tint of a petal is imitated by dipping it in coloured liquid and then moistening it with water, after which more dye is added in the part where the deepest tinge is required; the additional colour then radiates outwards producing less effect the farther it moves from its centre. A gloss is given to the upper surface of leaves by covering them with gum-arabic and scattering powdered nap of cloth over the gum when it has become sufficiently dry. Powdered glass and potato-flour also are sometimes dusted over the leaves and petals.

Fluid is a substance that allows indefinitely great deformation under the action of small stresses. In other words, the particles of a fluid are able to move about with more or less perfect freedom without being constrained to remain in the neighbourhood of other particles. This is the distinction between a fluid and a solid, and is expressed mathematically by saying that a fluid has no rigidity; the particles of a fluid can slide or *shear* past each other under the action of extremely small forces. [ELASTICITY.] The question of the time taken to effect this shearing does not occur in the definition, which, therefore, includes such substances as sealing-wax and pitch under the head of fluids rather than regarding them as solids; for experiment shows that these substances do actually undergo continuous change of shape under the action of such small forces as their own weights. Nevertheless, any attempt to effect similar changes in short time by the more sudden action of greater forces renders them solid-like in behaviour; they fracture rather than submit to the rapid deformation. Distinction must be made between a hard fluid such as sealing-wax and a soft solid such as a tallow candle. The latter is the more readily deformed by small forces, but the deformation reaches its limit almost immediately after the forces are applied. A tallow candle will not bend to an indefinite extent under the action of its own weight when supported in a horizontal position at its extremities, however long it be left in that position. A stick of sealing-wax will so behave in the course of weeks, and will ultimately fall down from its supports. Under the action of great shearing stresses there are various metals and other substances that behave like fluids in that they "flow" in the direction of the lines of force. In fact, most substances do so to some extent, though the amount of flow may be very slight before fracture and a dissociation of particles occur. Copper wire may be forced through holes of smaller diameter and come out the other side of greater length and smaller sectional area. If the metal be occasionally annealed, the process may be repeated again and again. Fluids proper are divided into two classes, liquids and gases. The distinction between these is that the former are practically incompressible under the action of small forces, whereas the latter are very readily compressible. Liquids have, therefore, a very great modulus of

elasticity of bulk, though small modulus of *rigidity* or elasticity of form, whereas both moduli are small for gases. [GAS, LIQUID, ELASTICITY.]

Flukes, a group of parasitic worms constituting the order Trematoda. They are all composed of a single segment, and their form is typically flattened like a leaf, though some are cylindrical. They secure attachment to the body of their host by one or more suckers, whence they are often known as the "suctorial worms." The mouth usually leads to a pharynx, and this to a forked alimentary canal; there is, however, no anus. Except the abnormal genus *Bilharzia*, the Flukes are all hermaphrodite, and in some cases self-impregnation certainly occurs, as, e.g. in *Polystomum integerrimum*. The Flukes are divided into two groups according to whether they exhibit "alternation of generations" (q.v.) or not; if they do not they are known as the "monogenetic." In these development is direct, with some few exceptions, as *Calicotyle*, which lives in the Rays. All the members of this group are external parasites. The "digenetic" have one or more (usually many) nonsexual generations intervening between the egg and the mature sexual form: the adults are always parasitic in some vertebrate animals, while the larvae are free-swimming at another stage and live in mollusca in another. Both the monogenetic and digenetic forms are classified into families based on the number of suckers; thus the former is divided into the *Tristomea* and *Polystomea*, and the latter into the *Monostomida*, *Distomida*, etc. The best-known of the Trematoda is the Liver-Fluke (q.v.), *Fasciola* (*Distomum*) *hepatica*, which is the cause of the disease known as sheep-rot or liver-rot. An account of the structure and life history of this form, serving as a general type for the class, is given under Liver-fluke (q.v.). This species occasionally occurs in man, but is mainly found in ruminants. Among other human parasites belonging to the class are *Distomum ringeri*, which attacks the lungs, and the African *Bilharzia hematobia*, which lives in the blood-vessels of the bladder.

Fluor, FLUOR-SPAR or FLUORITE, calcium-fluoride (CaF_2), is a common mineral in metalliferous veins, being especially associated with lead-ores. It takes its name from the Latin *fluo*, I flow, from being used as a "flux" in the smelting of lead and copper; and it gives its name to the element fluorine (q.v.), which is obtained from it. Fluor is generally crystalline in cubes, or less commonly in octahedra, and is transparent, or nearly so. Being brittle, it breaks readily, having perfect octahedral cleavage; but it is 4 in Von Mohs' scale of hardness. It has a vitreous, often splendid, lustre, and is remarkable for the great range of colours in which it may occur: colourless, violet (the most common), blue, green, pink, or yellow. The violet variety is known as "blue John" in Derbyshire, and the banded form, alternately violet and colourless, is known as "Derbyshire spar," and is valued for ornamental purposes. Its specific gravity is about 3. Before the blowpipe it decrepitates, tinging the flame red; and, when heated with sulphuric acid, it gives off fumes of hydrofluoric acid

(HF), which corrode glass. This property is utilised in etching on glass.

Fluorene, a hydrocarbon of composition $C_{13}H_{10}$, which is found in the portion of coal tar boiling at about 300°C . It forms white crystals with a violet fluorescence, which melt at 113°C . and boil at 295°C .

Fluorescein, or **RESORCINOL PHTHALEIN**, results from heating phthalic anhydride with resorcinol (q.v.). It forms fine yellow-red crystals of composition $C_{20}H_{12}O_6$, which give by solution a yellowish-red liquid exhibiting a magnificent green fluorescence. By the action of bromine, *Eosin* (q.v.) is obtained, the basis of a number of dyestuffs, while its benzyl derivative forms a fine yellow dye known as *Chrysolin*. Owing to its capacity for strongly dyeing water, it is used for tracing underground streams.

Fluorescence, in physical *Optics*, means a special transformation of light-waves when received into an absorbing medium. Sunlight, falling on a dark object, usually raises its temperature, and causes it to emit heat. It does not send back light-waves again, but it has effected the transformation of light-waves of short period and wave-length into heat waves of longer period and wave-length. Energy is absorbed in the form of short waves and emitted in long waves—a process of degradation that occurs continually in nature. There is another form of degradation of the same sort, when light-waves are transformed into other light-waves but of lower refrangibility. Violet rays may be absorbed by a substance and emitted as green or red light; the new modification is still appreciable to the eye, whereas in the former case it was only appreciable to the touch. This latter transformation is known as *fluorescence*, and was first observed by Brewster to be effected by an alcoholic solution of chlorophyll; sunlight, passing into the green solution, exhibited a fine red track through the liquid. Stokes has shown that many substances are more or less fluorescent, such as bone, white paper, cotton wool, etc., and that the rays transformed may be of such high refrangibility as to be beyond the limit of vision when in the incident beam. The transformation of long waves into those of shorter period is termed *calorescence* (q.v.).

Fluorides are substances which may be regarded as derived from one or more molecules of hydrofluoric acid (HF), by replacement of the hydrogen by some element or group of elements. The acid itself may, therefore, be called *hydrogen fluoride*. Some of the most important fluorides are *calcium fluoride* (CaF_2), largely found naturally as fluor spar or Derbyshire spar; *cryolite*, a double fluoride of sodium and aluminium (Na_2AlF_6), used for the manufacture of soda and as a source of aluminium; and *potassium fluoride* (KF) of frequent use in pure chemistry. Many organic fluorides are known, and these, as in the case of the inorganic fluorides also, show great resemblance to the corresponding chlorides.

Fluorine (F, atomic weight 19), an element which, though its existence had been recognised since the beginning of the present century, has only been

isolated within recent years. It exists naturally, combined with calcium in fluor-spar (CaF_2), and with sodium and aluminium in *cryolite* (Na_2AlF_6), and in small quantities combined with other elements in the bones, teeth, etc., of the human organism. Though many chemists had previously attempted by various methods to isolate the element, it was first prepared in 1886 by Moisson, a French chemist, who obtained it by the electrolysis of dry liquid hydrofluoric acid (HF) containing dissolved in it some potassium fluoride (KF). Owing to the exceedingly reactive nature of the gas, the U-tube and all the other apparatus employed for the electrolysis, etc., consisted of platinum. The fluorine was evolved at the positive electrode. It is a gas of a faint yellowish-green colour. It reacts very energetically with most substances; thus silicon, boron, sulphur, arsenic, and antimony take fire immediately upon immersion into the gas, and iron and many other metals burn in it, if previously slightly heated. Most organic compounds take fire in the gas, and with hydrogen it at once explodes, even in the dark, forming hydrofluoric acid (HF) (q.v.). Owing to this energetic nature of the gas, the study of it has proved dangerous and laborious, and most of the knowledge is due to M. Moisson. Its atomic weight and properties show it to be intimately related to chlorine, bromine, and iodine, with which elements it forms the group known as the Halogens (q.v.).

Fluotype, a photographic printing process, invented by Robert Hunt in 1844, in which paper, coated with a solution of potassium bromide and fluoride and sensitised by silver nitrate, was employed. After exposure to light, the image was further developed by a solution of ferrous sulphate. It is not much used at present, but is interesting as being one of the early printing processes.

Flushing (VLISSINGEN, FLESSINGUE), a Netherlands town in Zeeland, on the isle of Walcheren, at the mouth of the West Schelde (which is here from 2 to 8 miles broad), 50 miles S.W. of Rotterdam and 38 miles N.W. of Antwerp. Its forts, together with a fort on the opposite side, command the river, with which it communicates by two deep canals, which admit large vessels into the town. There is a town-hall and an exchange, and a statue of De Ruyter, who was a native. There are a ship-building yard and a large floating dock. The chief industries are brewing, soap-making, fulling, and oil-making. From 1585 to 1616 Flushing was in the hands of the English as a pledge for debt, and in 1809 during the Walcheren expedition it was bombarded, and its old town-hall and other interesting buildings were destroyed.

Flute, a wind instrument, which has been in use from a remote period of antiquity. Among the Greeks professional players took part in religious celebrations, and contests of rival performers were a common feature of daily life. There are two kinds of flute—the *direct* and the *transverse*. The old English flute, or *flute-à-becc*, belonged to the former class; and it received its name from the shape of the mouthpiece at the upper end of the

tube, which was supposed to resemble the beak of a bird. Flutes of this kind are held by the player at right angles to the line of the face, whereas the transverse or "German" flute is held across the body. Transverse flutes have an oval-shaped mouth-hole in the side of the tube. The *flute-à-bec* had 7 finger-holes, but the modern instrument has 6 finger-holes and about 14 keys. The transverse flute supplanted the *flute-à-bec* about the middle of the 18th century, mainly owing to the influence of Handel, who made use of it in his orchestra. It has been much improved since his time, and now has a compass of nearly 3 octaves from the middle D to A sharp. Among the various kinds of transverse flute are the *tierce* or E flat, the octave, and the C piccolo.

Flute Mouths (*Fistulariidae*), an Acanthopterygian family with four genera, allied to the sticklebacks, from the Atlantic and Indo-Pacific. The anterior bones of the skull are produced to form a long tube, which ends in a narrow mouth. Like the Syngnathidae, they are called Pipe-fishes (q.v.).

Flutings, or **FLUTES**, a term of classical architecture, denoting the hollows or channels carved perpendicularly on the surface of columns. The Tuscan order alone has no flutings. On the Doric column there are 20, which are carried up as far as the capital, and are separated by a sharp edge or arris. Ionic, Corinthian, and Composite columns have 24 flutes, alternating with small fillets; in these orders the fluting ceases below the neck and above the base of the column. A series of convex beads is sometimes worked in the flutes to about a third of their height; this moulding, which is called *cabling*, does not occur in the Doric order. A kind of flute may sometimes be seen on Norman pillars, as, for example, in the crypt of Canterbury cathedral; and, as late as the 12th century, the ornament was used in Italy and other parts of the Continent. The mediæval flutings were often arranged in diagonal patterns, and afterwards assumed zigzag and other forms.

Flux (from the Latin, *fluo*, I flow). 1. Any morbid discharge from a mucous surface may be called a flux. The most common use of the term is in the expression "bloody flux," a synonym for dysentery.

2. A term used to denote those ingredients that are added to an ore in the process of reduction, for the purpose of separating out impurities and enabling the metal to run together. Siliceous impurity is removed by *white flux*, which combines with it to form a fusible glass; this flux is composed of a mixture of the carbonates of soda and potash. *Black flux*, which contains powdered charcoal and potassium carbonate, similarly removes siliceous matter from metallic ores at a high temperature in a furnace, and also helps to deoxidise any metallic oxide. Calcium carbonate, or limestone, is used in the reduction of iron ores, being much cheaper than the other carbonates. [WELDING.]

Fluxions, the name given to the differential and integral calculus as developed by Newton.

His representation of variable quantities as being described by a continuous motion of a point introduced the idea of "flow" from one value to another, and hence the term "fluent" for such a variable. The notation of the calculus adopted by Newton differed from that of Leibnitz, and was gradually replaced by the latter. Thus the differential coefficient (q.v.) of x with regard to t would in the former system be denoted by x and in the latter

by $\frac{dx}{dt}$.

Fly-catcher, any bird of the Passerine family Muscipapidae, with 44 genera and 283 species, very abundant in the warmer regions of the Eastern hemisphere and Australia, more sparsely distributed in temperate regions and absent from North and South America. The wings are long, and the feet slender; the bill resembles that of a swallow, and is set with bristles at the corners of the mouth to aid in retaining the insect prey. The type-genus Muscipapa has 12 species from Europe and Africa, and three of them are British summer visitants. The Spotted Fly-catcher, about 5½ inches long, is delicate brown above, with some darker spots; the breast is whitish, deepening into yellow on the sides and marked with long brown streaks. It has no song, but a few twittering notes. The Pied Fly-catcher (*M. atricapilla*), with black and white plumage, is somewhat smaller; *M. parva*, the Red-breasted Fly-catcher, has been known to occur. As their name denotes, all these birds prey largely upon insects.

Fly-wheel, in *Engineering*, means a large wheel with heavy rim, worked by an engine for the purpose of storing up energy and so acting as an accumulator, from which energy may be taken as required. In certain engines that are uniformly driven, and whose energy is uniformly abstracted at the same rate, a fly-wheel is unnecessary. In others the energy is required at a uniform rate, but is supplied irregularly as in the case of a foot-lathe or of a high-pressure engine, where the full pressure of steam in the cylinder only lasts for a small fraction of the stroke. In others the demand for energy is intermittent, so that it could not, except with much waste, be taken direct from the engine; such a case is seen in the rolling-mill (q.v.); while the metal is between the rolls the demand for energy is great; when the metal has passed through, the engine, of course, goes on, but there is little call on it. Finally, in cases like locomotives, the engine works direct on such heavy masses that these act as accumulators without requiring a rotary motion.

Flying signifies the lifting and propulsion of a body into the air by means of a supply of self-contained energy. The elevation of a balloon into air is due to its small density, the bulk of air actually displaced being of greater mass than that of the balloon itself; the balloon does not lift itself by means of a store of kinetic energy it possesses, but is thrust upwards by the surrounding fluid just as a bubble of air is thrust upwards through water. Moreover the balloon itself, without engines and

propellers on board, cannot direct its motion, excepting in so far as it may vary its height by throwing out ballast or by permitting the escape of gas. It can only in part regulate its horizontal movements, and then only inefficiently, by choosing its elevation and submitting itself to the wind that may blow horizontally at that elevation. A balloon fitted with some such mechanism as a screw-propeller, and supplied with sufficient motive power to work the screw rapidly, partially solves the problem of producing a flying-machine, but only partially; for a flying bird has a density greater than that of air. Whether it has any arrangement for introducing air into portions of its structure, and so rendering itself specifically lighter than before, does not alter the fact that it is always specifically heavier than air. A bird shot dead while on the wing falls to the earth at once; its mass is the same, but its energy is now unavailable.

A bird could not fly unless air were present. If placed in a vacuum, for all its flapping of wings it would fall vertically with determinate acceleration. Thus the air is essential to its flying, and it is air-resistance that in some way prevents falling. An ordinary china plate dropped into a tank of water will not fall vertically, but will oscillate from side to side, and take some time to reach the bottom. In certain parts of the motion the plate actually moves upwards, in opposition to gravity, and evidently enabled to do so by reason of its kinetic energy, as a pendulum-bob rises for half its swing by reason of its kinetic energy at the lowest point. It is clear that the shape of the plate has much to do with this sliding motion backwards and forwards through the liquid, for the path of motion is immediately affected by altering the convexity of the plate. The case of a boomerang (q.v.) is also interesting in this connection; this weapon may by skilful projection be made to travel obliquely upwards on an "inclined plane" of air and to return by nearly the same route. In both these cases special initial motions, combined with special shaping, may produce resultant motions that are in opposition to those laws of gravity which only hold so long as the effects of air-resistance are disregarded. But neither the plate nor the boomerang are able to alter their shape during flight, nor to change by exertion of force their supply of kinetic energy or their speed of motion. And now to come back to the bird; such a creature has developed a system specially adapted to take advantage of air-resistance and to alter its shape from time to time, and a muscular power that is simply tremendous in proportion to its total weight. Birds rarely weigh more than 30 lbs.; and their weight is never condensed into a volume of small surface area, but is spread out so as to be very thin in one dimension and extended in the other two. Given at one instant a bird in the air with a certain imparted speed obliquely upwards, simultaneous motion of the individual feathers may so modify the ordinary force-relations as to send the bird sailing along a path that is certainly not parabolic. [GRAVITY.] Tail guidance may render this path at will either rectilinear, circular, spiral, or otherwise curved with greater complication. And so slight is the

friction between the surface of the bird and the air that straight-line horizontal motion of this passive nature may continue for very great distances before the speed of the bird is perceptibly diminished; and, excepting for the effort of guidance, it would seem as though the bird moved without exertion. Instantaneous photographs of flying birds, taken by Marey and by Anschütz, have shown that the individual feathers do so modify their relative positions in the manner just mentioned. During a stroke of the wing downwards the feathers are ranged so as to offer far more resistance to the air than during the upward movement. Their motion may perhaps be roughly compared to the opening and closing of Venetian blinds; the feathers are closed during the downward stroke and open during the return. A hawk in descending vertically upon its prey probably keeps its wing-feathers open so as to fall the more rapidly, its wings being extended for the sake of a truer balance.

Some idea of the nature of flying may now be understood; when the reason of "sailing" in the air is clear, the question of propulsion becomes much simpler, and is indeed that part of the problem of flying that is likely to be the first solved by mankind. Self-propulsion is nevertheless practically independent of "sailing," though the mechanism which makes the one possible to the bird also renders the other possible. The swimming of a fish by movement of its fins is precisely similar to the self-propulsion of a bird. But in the one case the medium is an almost incompressible fluid; in the other case the fluid is highly compressible. Yet the modified and enlarged fins of a flying-fish enable it to "swim" through the air for short distances, and this great difference in the two media would seem to demand not disproportionate strength and energy of the flying mechanism, but the special ability to vary its shape and surface.

Attempts have been made by mankind from time immemorial to construct flying machines, but until very recently without success. There are two systems of aerial navigation: ballooning and the heavier-than-air system which implies abandonment of the gas-filled bag and reliance upon mechanical means to attain flight. The navigable balloons, airships, or dirigibles consist of torpedo-shaped, gas-filled vessels propelled by one or more screws. Machines heavier than air are of various descriptions; the most important is the aeroplane. It consists of one or more planes, slightly concave beneath, which rise and are sustained owing to the accumulated pressure of air on the nether surfaces when propelled at a rapid rate. Great attention is being given to aerial navigation by military experts of all the Powers. There is a Military Balloon Department at Farnborough in Hampshire. In 1907 a military airship travelled from Aldershot to London, but was wrecked by a high wind while anchored at the Crystal Palace. This airship was reconstructed and successfully tried in July, 1908. [BALLOON, AERONAUTICS, AEROPLANE.]

Flying Buttruss, a structure built across the span of an aisle, to resist the thrust of the roof.

Flying Fish, any individual of the genus *Exocoetus*, with 44 species, from tropical and sub-tropical seas, two of them—*E. evolvans* from the Indian Ocean, and *E. volitans* from the Mediterranean—sometimes wandering to the British shores. They are from ten to twelve inches long, though specimens of eighteen inches are recorded, with the pectoral fins reaching in some to the anal fin, and in others to the tail. Kingsley thought that the motion of these fish through the air was true flight, and others have come to the same conclusion. It appears, however, to be a leap prolonged by the parachute-like action of the fins, which are kept distended; and any deviation from a direct course is due to currents of air, not to the will of the animal. The rate of "flight" is about 10 miles an hour, but it can only be kept up for about 500 feet. [FLYING GURNARD.]

Flying Fox, a name for any individual of the family Pteropidae, from their fox-like head. They are also called Fruit Bats, from their diet. [BAT.]

Flying Gurnard, any of the three species of *Dactylopterus*, from the tropical Atlantic, Indo-Pacific, and the Mediterranean. Adults attain a length of 18 inches, and take flight-like leaps, like the Flying-fish (q.v.), aided by their abnormally long pectoral fins. The young fish cannot "fly."

Flying Lemurs, an aberrant family (Galeopithecidae), sometimes classed with the insectivora, but really linking them with the Bats, and having also marsupial affinities. *Galeopithecus volans*, probably the only species, from the Indian Archipelago, is about 20 inches long, of lemur-like appearance, clothed in soft fur, dark coloured and mottled with white above, tawny grey below. It is nocturnal in habit, and the diet is chiefly vegetable, varied with insects and small birds. It climbs well, and passes from tree to tree by its "flying" apparatus, which consists of a patagium, to which are added antibrachial and interfemoral membranes as in the Bats (q.v.), and there are membranes between the digits.

Flying Machines. [FLYING.]

Flying Phalanger, a name for several small marsupials of the genus *Petaurus*, and allied genera or sub-genera, from New Guinea and Australia, differing little from the true phalangers, except in that they have a patagium (q.v.). The largest is about the size of a cat, and the smallest no bigger than a mouse. They are nocturnal in habit, and feed on fruit and insects. It is said that they have been seen to modify their course when in motion through the air. *P. australis* is the Yellow-bellied, and *P. aciurens* the Squirrel Flying Phalanger, and *P. pygmaeus* is the Opossum, or Flying Mouse.

Flying Squirrel, a name for any squirrel having a patagium (q.v.). Of these there are three genera: (1) *Anomalurus* (often made a separate family, *Anomaluridae*), with five species, from West Africa. There are peculiar plates on the under surface near the root of the tail, which evidently assist the animal in climbing; (2) *Pteromys*, with

twelve species, ranging from the Western Himalayas to Java and Borneo, and containing the round-tailed flying squirrels; and (3) *Sciopterurus*, with about sixteen species from Northern Europe, Asia, and America, containing the flat-tailed flying squirrels. The *Platouche* (*S. volans*), about the size of a rat, is found in the north-east of Europe.

Focus, in *Physics*, is a point of concentration of waves of air, water, ether, or other medium capable of transmitting wave motion. The term is more exclusively applied to waves of light and heat, the familiar instance of the concentration of the sun's rays to a point by means of a burning-glass showing at once a focus of light and of heat. In optics a focus is *real* if the waves actually do reach the point; it is *virtual* if they only seem to proceed from or towards the point; it is a *principal* focus if it is the point to which plane-fronted waves may be directed by suitable reflection or refraction. An instrument for determining the positions of the principal foci of lenses is called a *focimeter*; one for "focussing" or bringing the clearest image on the ground-glass of a photographic camera, is called a *focimeter*. The distance from a lens or mirror to its principal focus is called its *focal length*. In *geometry* the focus is a special point in relation to the conic sections, from which the distances of points on the curves may be conveniently measured.

Fodder, the food of domestic herbivorous animals, provided for them through human industry. In England the term is usually applied to dried vegetable produce, such as hay and straw. Domestic herbivorous quadrupeds obtain the chief part of their food from the grasses, which are eaten when fresh and green—Italian rye-grass, timothy, etc. Many of these grasses are artificial, and include such *Leguminosae* as clover, vetches, lucerne, etc., which, when eaten green, are called forage-crops. Clover and cabbage are especially valuable. The winter food of these animals is furnished by dry fodder, roots, and seeds. *Dry fodder* consists of *straw*, the dried stems of cereals and leguminous plants; and *hay*, dried grasses which are grown especially for this purpose. Hay is more nutritious than straw, because it is cut while the plant is still young, and contains a large amount of sap. Some kinds of straw, however, especially pea-haulms and oat-straw, are little inferior to hay, if they are cut early and protected from wet. Hay is, to a large extent, composed of *leguminosae*, as these are sown among the natural grasses, and cut and dried at the same time. The number and proportion of the ingredients is consequently very variable. The herbage of water-grass meadows is considered superior to that of dry meadows.

Fetus, the name given to the mammalian embryo from the time when the changes which take place in the ovum after fertilisation have resulted in the formation of the rudiment of the offspring until birth. The human fetus at the end of the first month of pregnancy is about one-third of an inch in length, the rudimentary eyes and ears are just distinguishable, and four bud-like processes represent the future limbs. By the end of the

third month the embryo exceeds three inches in length; the head is separated from the trunk by the formation of a distinct neck; ossification has commenced in most of the bones, and the placenta or after-birth, through which the fœtus is now to derive its nourishment, is already formed. By the end of the fifth month the fœtus weighs nine or ten ounces; the various features of the face have considerably approximated towards their ultimate shape, and fetal movements can now be felt by the mother. By the end of the seventh month the fœtus has attained a length of some fifteen inches, and weighs about forty ounces. After this period the fœtus becomes *viable*—i.e. if born, it may possibly be reared. The fœtus at term averages about twenty inches in length, and weighs about seven pounds; the *fontanelles*, a large anterior and smaller posterior membranous interspace between the bones of the skull, are widely open; ossification is still very incomplete, too, in the bones of the limbs and trunk; the series of changes in the circulatory apparatus which adapt the child for the change from the fetal circulation to that of the distinct individual, are now well-nigh complete, though the closure of the foramen ovale, which connects the two ventricles of the heart, and the complete degeneration of the fetal structures known as the ductus arteriosus and ductus venosus, are not effected until a few days after birth. The peculiarities of the fetal circulation cannot be discussed in detail here; suffice it to say that the pulmonary circulation is, of course, not yet established, and that aëration of the blood is effected in the placenta, while the structure of the fetal heart is adapted to the special conditions for securing a flow of blood to the various parts which obtain.

Fog. 1. The formation of cloud from water-vapour in the air seems to require the presence of nuclei on which the particles may commence to aggregate. These nuclei are afforded by dust in the air, and the resulting cloud varies in appearance with the nature of these dust particles and the magnitude of the aggregations. Its deposition on the dust particles, like its deposition on the ground as dew, will depend on the amount of water-vapour that the air may possess and on the temperature of that layer of air. [Dew.] The cooling of warm air well laden with moisture and containing also a certain amount of dust, will generally cause the formation of cloud, mist, or fog, between which terms no definite distinction can be made. So long as the suspended globules of water remain very small they will be supported by air-resistance and carried about by air-currents; but if they unite and become enlarged they may become too heavy for suspension and fall as rain. Cold water may cool warm air down below the dew-point and so produce fog; this may be seen frequently on marshy land at evening, and is the cause of the coast-fogs of Nova Scotia and other parts. The blackness of London fogs is due to the smoky nature of the particles on which the water-vapour is deposited. The smoke particles are charged with heavy hydrocarbons, and become of a greasy consistency, when they accumulate moisture also. Such fog is highly

injurious to animal life, and its prevention is in every way desirable. The simplest method seems to be to prevent the passage of smoke into the air. Smoke is fuel and should not be wasted; its loss in air is uneconomical, and is in the above indirect way dangerous. The aim, therefore, should be to render the carbon-combustion in all furnaces, fires, etc., as complete as possible, so that the products of combustion shall be gaseous and shall contain nothing of the ordinary smoke.

2. In photography, a dark stain which covers a negative, and which may be due to various causes, usually one of the following: over-exposure, use of too much alkali in the developer, a dirty negative plate, exposure to light before or during development. Stains on the plate due to use of a discoloured developer usually disappear during washing, but fog from either of the above causes remains more or less permanent.

Fog Signals. signals made during foggy weather to prevent collisions, shipwrecks, and other accidents. On board ships it is usual to ring the time-bell at short intervals, and to beat a gong, fire musketry, or produce some other striking sound. The use of such variable signs can but vaguely indicate the whereabouts or the course of a ship, and it has been proposed to adopt a general code for all classes of vessels like that employed in the British navy. Here a bell signifies that a ship is at anchor, and a long whistle repeated within two minutes that she is approaching under steam; while a single blast on the foghorn gives notice that she is sailing on the starboard tack, and two blasts together repeated within two minutes that she is on the port tack. For warning ships off a dangerous coast, foghorns and whistles are more efficacious than bells or guns, since a strong wind blowing landwards will prevent the latter from being heard at any distance from the shore. The most powerful foghorn is the "Siren." It is furnished with two discs, each containing twelve radial slits, one of which revolves in front of the other, where a large trumpet of cast iron is attached. The moving discs make 2,800 revolutions per minute, so that the slits are together 33,600 times every minute; on each occasion compressed air is made to pass through them, and afterwards reverberates through the trumpet, producing a powerful sound, sometimes audible at a distance of 10 miles. The fog-signals used on railways consist of detonating caps, which explode when an engine passes over them.

Foggia, a town of South Italy, and an important railway junction, in the province of the same name, 79 miles N.E. of Naples. It has regular streets of good houses, and among its public buildings are a cathedral, the governor's palace, and a theatre. It is the centre of a corn-growing district, and has extensive granaries beneath the streets. Its productions are cattle, capers, wine, and wool, and there is an important annual fair.

Foix, COUNTS OF, were members of an old family of the south of France. The first was Roger, born in 1064. Another, Raymond, took part

in a crusade, and was with Philippe Auguste at the siege of Acre. His estates were afterwards forfeited for his siding with the Albigenes, and he died in 1223. Gaston III., called Phosbus on account of his manly beauty, was made governor of Languedoc and Gascony for his services to the king. Gaston IV. did good service for Charles VII. against the English. His grandson became Duc de Nemours (1505), and earned the epithet of "Thunderbolt of Italy." He beat the Swiss, chased the Papal troops, and seized Brescia from the Venetians, and won the battle of Ravenna against the Spaniards in 1512, paying for the victory with his life at the age of 23. The title then passed to the King of Navarre, and so eventually to the French Crown. Froissart tells us of the tragic accidental death of one of the family at the hands of his father.

Fokshani, a Wallachian town on the Miklov, on the border of Moldavia, 92 miles N.E. of Bucharest. It has a suburb in Moldavia on the left bank of the river. It was burnt in 1822 by the Turks, having been once before destroyed by the Russians in 1789.

Fololand, or **FOLKLAND**, in early English history, the public land of the nation, originally the remainder after provision had been made for each family and township. It was under the control of the king, subject to the counsel and consent of the Witan. Large grants of it were made in course of time, both to the monasteries and to the "new nobility" of thegn, and leases were granted which eventually gave rise to prescriptive rights over it. At the Norman Conquest it became the king's land, and was confounded with his private property. Its existence was doubtless a survival from the time when land was corporate property only, and the idea of individual ownership had not yet developed. There were analogies to it in early Germany, in mediæval Switzerland, in early Greece, and more particularly in the *ager publicus* at Rome. But in the continental states of early mediæval Europe it was not generally distinguished from the king's land.

Foley, JOHN HENRY, R.A. (1818-1874), a British sculptor, was born in Dublin. After obtaining several prizes at the Dublin Royal Society of Art, he came to London in 1834. He first exhibited in 1839, his earliest works being the *Death of Abel* and *Innocence*. He became A.R.A. in 1849, and R.A. in 1858. Among his many works are the group *Asia* and the statue of the Prince Consort on the Albert Memorial, the statues of Hampden and Selden in Westminster Palace, and those of General Outram in Waterloo Place and J. S. Mill on the Thames Embankment.

Foley, SIR THOMAS, naval officer, born in 1756, became a captain in 1790, commanded the *St. George*, 98, in Hotham's two actions in 1795, was flag-captain to Sir Charles Thompson in the *Britannia*, 100, at the battle of St. Vincent, led the fleet into action in the *Goliath*, 74, at the battle of the Nile, and was Nelson's flag-captain at Copenhagen. He became a rear-admiral in 1808,

commander-in-chief in the Downs in 1811, a vice-admiral in 1812, and an admiral in 1825, and died rear-admiral of Great Britain and commander-in-chief at Portsmouth in 1833.

Folgore, of San Geminiano, an Italian poet of the 13th century. He wrote sonnets, which are valuable as throwing light upon his times. They have been translated by Dante Rossetti and J. A. Symonds, and contain much striking imagery. It has been said of them that "every line is a picture," and that every picture has the "charm of miniature upon a missal marge."

Folkestone, a seaport in Kent, 6 miles S.W. of Dover and 69 miles from London, is situated partly on the shore and partly on a cliff overlooking the sea, which has encroached at different times and swept away four out of the five original churches of the town. The one that is left has a central tower, and is conspicuous from its position on the cliff. There are a battery and three martello towers. The town is now a flourishing watering-place, and owes much of its prosperity to the fact of the South-Eastern Railway having made it the point of their cross-channel service to Boulogne. Folkestone was important in Roman and Saxon times, and suffered much from Danish inroads and French raids. Pop. (1901), 30,694.

Folk-lore. Folk-lore is a modern and apt term adopted to designate the scientific study of popular antiquities. That there was anything of value in the traditions, suggestions, and customs of the people was hardly surmised till the 19th century, when attention was drawn to them by the brothers Grimm—notably by the *Deutsche Mythologie* of Jakob Grimm, in 1835, which may be termed an epoch-making work, as it opened the eyes of men to the vast amount of material to be gleaned from the people which elucidates the ancient religious beliefs and customs of the race. Before this date the Grimms had published their collection of folk-tales, *Märchen*, in three volumes. The last volume was itself a revelation, as it showed how that a common stock of household tales was to be found widely dispersed through the Aryan race. The *Volksmärchen* were published in 1812-1822, and the *Sagen* or collection of traditional tales in 1816-1818. In England, H. Bourne, in his *Antiquitates vulgares*, 1725, and J. Brand, in his *Popular Antiquities*, 1777, and Hone, in his *Every Day Book*, 1826, had collected much that was interesting; but no attempt was made in England to treat English folk-tales, superstitions, and legends in a scientific manner till Thomas Keightley took the matter up, and wrote his *Fairy Mythology* in 1828, and his *Tales and Popular Fictions* in 1834; both were written under the influence of the research of the brothers Grimm. "Folk-lore is often the only possible means of penetrating to the prehistoric past of nations, and it is certainly the only means of tracing out many of the landmarks in the mental development of man." By means of folk-lore we are able to explore extinct religions, cosmogonies, social organisation, of a time long past, and concerning which historians have left us hardly a word. Folk-lore is divisible under five main heads—(1)

Superstitious beliefs and practices; (2) Traditional customs; (3) Traditional narratives; (4) Folk sayings, proverbs, etc.; (5) Folk music.

1. Under the first head are comprised all the superstitious usages or beliefs relative to natural objects, plants, and animals, the phenomena of earth, sea and sky; also all such as relate to the spirits of the dead and to supernatural beings, as fairies, dwarfs, and ghosts. Also beliefs having reference to witchcraft, divinations, the evil eye, things and seasons that are lucky or unlucky. It is found that the ancient deities of a race, or the deities of a conquered race, became the demons of the victorious religion and people. Thus Baal, the great god of the Canaanites, was regarded as Beelzebub, a demon, by the Jews. So also the Dusii of the Celts, woodland spirits, became to us the Deuce, Bog, the Slavonic great god, is degraded into a Bogie. Uggr, one of the titles of Odin or Woden, the over-lord of the Norse and Teutonic peoples, has sunk to be the Ogre of nursery tales. Skratli, a forest hairy spirit, is now Old Scratch—the Devil. Consequently, by a study of superstitious beliefs and practices, we are able in part to reconstruct the religion of our forefathers before St. Augustine landed in Kent.

2. Traditional customs represent not only the ritual of a displaced religion, but reveal to us many of the social usages of a condition when civilisation was only dawning. Thus the casting of an old shoe after a bride is a reminiscence of the time when the authority for life and death over the woman was made over by the father to the husband; and the salutation by raising or touching the hat is a far-off reminiscence of the period when no man but the chief could have his head covered, and the bared head was an acknowledgment of feudal dependence.

3. Traditional narratives in prose or verse are of the highest importance. They comprise nursery tales, historic legends, stories attaching to places and families, also ballads.

Some of the household tales enable us to reconstruct the mythology of lost religions; others elucidate early customs. For instance, in folk-tales the youngest son is usually the successful one of the family, and this points to the period when the family estate and house went, as it still does in the Black Forest in Germany, not to the eldest, but to the youngest son. [BOROUGH ENGLISH.]

Children's games are also of much more importance than could have been supposed; they often are an after-glow of lost religious ceremonials.

4. Folk sayings and proverbs reveal to us the powers of observation of nature among those living in the country, also give the measure of their experience of life and their solution of its mysteries.

5. Lastly, folk music is deserving of collection, as it furnishes us with much fresh and fine melody, often set in ancient *modes*, in which no music has been composed for over a century, perhaps two. As the modern ear is accustomed to music in one of the eight modes only, it cannot understand and appreciate music which does not belong to the modern conventional form; but much of the ancient music of Europe was composed in the seven other

modes, and was not committed to writing, unless it were ecclesiastical. Consequently, it can only be recovered traditionally. None of it goes back, indeed, to prehistoric times, but a good deal dates from before the reign of Henry VIII. Scotland is justly proud of its magnificent store of ballad poetry. This treasure was at one time diffused over all England as well, but was never collected in England from the people, as it was in Scotland, by Herd, Motherwell, Scott, etc. All our collectors went to printed broadsides—comparatively recent compositions; it never occurred to them to go to the people; consequently we in England have not more to show than a few specimens of what was once as rich a growth among our people as in Scotland.

For the collection of popular antiquities accuracy is essential; and no better guide can be recommended than *The Handbook of Folk-lore*, edited by Mr. Gomme, for the Folk-lore Society (published by Nutt, London, 1890). Many a well-intentioned work on traditions and folk-tales has been rendered worthless by unscientific treatment, or through inaccuracy in the taking down of particulars.

An admirable scheme of analysis of folk-tales was proposed by Hahn in his *Griechische u. Albanesische Märchen* (1864), in which he showed how all such stories could be reduced to skeletons, and then grouped.

Folk-moot (Meeting of the People) is the old English name for the great assembly of the nation for political and judicial purposes. It answers to the Campus Martius or Madius of the Franks, the Swedish Ting, and the Icelandic Althing. It differed from the Witenagemot (q.v.) in being composed of all freemen, and not of the great men alone. There was never a Folk-moot of all England, but only of the separate kingdoms. The Shire-moot, however, was a complete folk-moot for the district comprised in the shire.

Follicle, a dry, many-seeded, one-chambered carpel which splits, when ripe, down one suture, generally the ventral suture. This latter character alone differentiates it from the legume (q.v.), which splits down both sutures. A single follicle seldom forms a fruit by itself, though it does so in some species of larkspur (*Delphinium*). More commonly two, three, five, or more, occur in a ring, as in the peony, most larkspurs, columbines, aconites, hellebores, and marsh marigolds (*Calitha*), and in the flowering-rush (*Butomus*); or a still greater number may occur arranged spirally in an *etario* (q.v.), as in *Magnolia*. [FRUIT.]

Fomentation, the application of flannel wrung out of hot water to a painful part is at times attended with considerable relief. Various drugs which contain sedative ingredients (poppy heads, turpentine, etc.) may be added to the water, though doubtless the main point to be attended to is the warmth. The fomentation should be as hot as can be borne with comfort by the patient.

Fonblanque, ALBANY WILLIAM (1797-1872), an English journalist, was educated for the bar, but took to journalism and joined the *Morning Chronicle*, and afterwards became leader-writer,

editor, and proprietor of the *Examiner*. In 1852 Lord John Russell made him head of the Statistical Department of the Board of Trade, and from that time his connection with journalism almost ceased. In 1837 he published *England under Seven Administrations*.

Font, the receptacle of the baptismal water in churches, usually consists of a basin hollowed out of a solid block, and supported upon a pedestal. It is now generally about 2½ feet in diameter, but was formerly large enough to hold the body of the child, who was immersed. Most fonts are of stone, but ancient leaden ones are to be seen. They are generally placed at the western end of the church, but sometimes stand in a separate chapel. Anciently the font was in the baptistery of the Cathedral Church only. It is so still in some of the cities of Italy. Fonts in almost every style of architecture exist in England. A fine example of the Decorated is in the church of All Saints, Norwich; and of the Perpendicular there is a perfect specimen at St. Nicholas, East Dereham, Norfolk.

Fontainebleau, a town in the French department of Seine-et-Marne, in the middle of a forest of the same name, 2 miles from the Seine and 37 miles S.E. of Paris. The town is well-paved and has good streets, and has among its public buildings good barracks, a library, a college, public baths, and hospitals. There are sandstone quarries much used for paving purposes, and manufactures of calico, porcelain, and stoneware. The palace, which stands in a beautiful park, and is surrounded by 85 square miles of forest, was a royal residence as early as the 12th century. Henri IV., Louis XIV., Napoleon, and Louis Philippe spent much money upon beautifying it; and it was here that Napoleon signed his act of abdication in 1814.

Fontanes, LOUIS, MARQUIS DE (1757-1821), a French poet and politician, was born at Poitou. He went to Paris in 1777, and the next year produced *La Forêt de Navarre*. Other works of his were *Ori de mon Cœur*, *Le Jour des Morts à la Campagne*, *Le Verger*, *La Chartreuse de Paris*, and a translation of Pope's *Essay on Man*, accompanied by an introduction. At the Revolution he became a journalist, and went to Lyons and other places. At first he was in favour with the authorities, but was afterwards forced to take refuge in England. He wrote an *Éloge* on Washington for Napoleon, at whose fall he joined the king's side and was made a peer, and received other honours. His works were edited by Sainte-Beuve in 1837.

Fontenelle, BERNARD LE BOYER DE (1657-1757), a French centenarian and writer, was born at Rouen. He was so delicate in childhood that it was considered impossible that he should grow up. His mother was a sister of Corneille (q.v.). Fontenelle was educated at the Jesuit College at Rouen, and became an advocate, but soon abandoned law. In 1674 he came to Paris, and attracted notice by his poems and other writings. He collaborated in some operas, and in 1681 produced a tragedy, *Aspar*, which was a failure. In 1683

appeared his *Dialogues of the Dead*, and in 1686 his *Entretiens sur la pluralité des Mondes*. He also wrote many *Eloges*.

Fontenoy, a village of the Netherlands in Hainault, noted as the scene of a French victory gained on May 11, 1745, by Marshal Saxe, over an allied army of British, Austrians, and Dutch.

Fontevrault, a French commune in the department of Maine-et-Loire. It is situated in the middle of a forest in a valley 10 miles S.E. of Saumur. A Benedictine abbey was founded here in 1099, and was notable as containing both monks and nuns, the Abbess being the head of the whole in honour of our Lady. The duties were divided between the sexes on the old principle that Adam should delve and Eve spin. The abbey had many dependencies, there being thirty of them in Brittany alone. The last Abbess was a niece of Madame de Montespan. Henry II. and his wife Eleanor, Richard I., and the wife of King John are English sovereigns buried here.

Foochow, capital of the province of Fokien in China. It is situated on a hill-surrounded plain on the left bank of the Min, 125 miles N.E. of Amoy. The town proper is contained by a wall 30 feet high and 12 feet wide, with seven gates with towers, and there are suburbs on both sides of the river connected by a stone bridge. The streets are dirty, and there are several temples. Foochow is one of the five treaty ports created in 1843, but the navigation is difficult. The exports are tea, timber, tobacco, bamboo, fruits, potash, and paper; the imports opium, lead, cottons, and woollens.

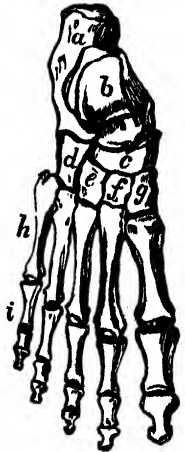
Food. The term "food" is usually applied to the various substances taken into the body through the mouth, which serve to counterbalance the waste of the tissues. In a general survey of the substances which enter the body, air would necessarily be included, and the oxygen of the air has every claim to be considered a food. In the present article, however, the term "food" will be limited to the solid and liquid substances which enter the body through the alimentary canal. On the supposition that the weight of the body remains constant, it is only necessary to know accurately the amount of the several chemical elements contained in the excreta, to estimate the quantities of these elements which must be taken into the body to replenish waste. It must, of course, be borne in mind that any given element may be eliminated in various ways, and in striking a balance between the substances taken in and the substances eliminated it must not be forgotten to include in the former both what enters by the lungs and by the stomach, and in the latter not only what is discharged from the alimentary canal, in the urine, and from the skin, but also what is exhaled in the expired air. Again, the food is the great source from which the body derives its energy, and the chemical composition of substances excreted differs markedly from that of substances ingested; in fact, in correspondence with the energy imparted by the food to the body, it is found that the excreta are composed of substances representing but little work-

producing capacity, while the ingesta are made up of substances possessed of considerable potential energy. The various food stuffs may be divided into two great classes:—*Organic* and *inorganic*, the former comprising (1) nitrogenous foods (proteids and their allies), and (2) non-nitrogenous foods (sugars, starches, and fats). The inorganic foods consist of mineral salts and water. (For the composition of proteids, fats, sugars, and starches, see DIGESTION.) To come now to the principal forams in which the various food stuffs occur. Lean meat contains from 15 to 20 per cent., milk upwards of 4 per cent., white of egg upwards of 20 per cent., peas, beans, etc., upwards of 25 per cent., wheat flour upwards of 10 per cent., and cheese from about 30 to 40 per cent. of *nitrogenous substances*. *Fats* occur in the fat of meat, in butter, lard, suet, and the various oils. *Starches* enter largely into the composition of most vegetables, especially potatoes, and constitute nearly half the weight of bread. *Sugars* are widely distributed, being especially prominent constituents of fruit and vegetables, and forming 5 per cent. by weight of milk. *Mineral salts* enter more or less largely into the constitution of all foods (nearly 2 per cent. in flour, nearly 1 per cent. in milk, 4 or 5 per cent. in flesh). Green vegetables and fruit supply certain salts not readily obtained from other articles of food, and the health of the body seems to suffer if they are entirely excluded from the diet list. A reference to the chemical constitution of the chief food stuffs will show that the elements which enter most largely into their composition are carbon, oxygen, and nitrogen. Oxygen is obtained, of course, in large quantities from the air. It may be well to consider the relative proportions in which the two remaining elements should exist in foods. In order to counterbalance the waste occurring in an ordinary healthy adult, it is necessary to supply daily about 4,500 grains of carbon and nearly 300 grains of nitrogen. Now in proteid foods there are from three to four times as much carbon as nitrogen, while starches, sugars, and fats contain no nitrogen at all. The necessity for a mixed diet thus becomes apparent; for if an individual were restricted to proteid food, he would clearly have to consume a large excess of nitrogen if he is to obtain the necessary amount of carbon, while, on the other hand, it is manifest that no amount of starches, sugars, or fats would supply him with the required amount of nitrogen. The proportions of the various food stuffs which exist in milk are such as to exactly meet the requirements of the infant in respect of carbon and nitrogen, and for this reason milk is sometimes spoken of as a "perfect food." Much has been written concerning the several parts played in the animal economy by the various food stuffs. It is clear that fats are in the main heat producers; hence the large share they occupy in the diet of the inhabitants of cold countries. The starches and sugars seem to be in part converted in the body into fat. The changes which the proteids undergo are very complex; they appear to be essential to tissue formation. The mineral salts must enter into the composition of the diet in a certain proportion for the maintenance of health.

The amounts of the several food stuffs, which should be comprised in the diet of a healthy adult taking moderate exercise, are:—Nitrogenous substances, about 5 oz.; fats, about 3 oz.; starches, about 15 oz.; salts, a little more than 1 oz. These figures represent weights of water-free food stuffs; in practice these food stuffs are met with combined with 50 or 60 per cent. of water, for which allowance may be made. In addition to the water which is contained in ordinary solid food, some three pints of liquid will be required *per diem*.

Fools. THE FEAST OF, was a mediæval semi-Christian survival of the Pagan Saturnalia of ancient Rome. The Church authorities at first strenuously opposed it, but with so little success that the observance came to have something of a religious character. Thus, the scene of action was generally a church, in which the travesty of an election of a Pope, cardinal, or other ecclesiastical dignity, calling himself "Pope of Fools," "Boy Bishop," "Abbot of Unreason," or the like, would take place. Sometimes even a mock celebration of the mass was enacted; and sometimes an ass would be led up to the altar to the strains of a hymn. In this case the name "Feast of Asses" was given to the grotesque proceedings. The Reformation, it would be thought, would have made short work of such observances, but at Antibes, near Nice, the Feast of Fools was observed so late as the year 1644. The authority on the subject is Du Tillot: *Mémoires pour servir à l'histoire de la Fête des Fous*, 1741.

Foot. 1. The bones of the foot may be divided into three groups—viz. *Tarsus*, *Metatarsus*, and *Phalanges*. The bones of the *tarsus* are seven in number—viz. the astragalus, os calcis, cuboid, scaphoid, and the three cuneiform bones (internal, middle, and external). The astragalus articulates with the tibia above, entering into the formation of the ankle joint; it rests upon the os calcis below, and articulates with the scaphoid in front. The os calcis forms the bony prominence of the heel. The cuboid is situated in front of the os calcis on the outer side of the foot, and articulates anteriorly with the fourth and fifth metatarsal bones, and internally with the external cuneiform bone. In front of the scaphoid on the inner side of the foot is the internal cuneiform bone; just external to it is the middle, and outside this again is the external cuneiform bone. In front of the tarsus is the *metatarsus*, consisting of five bones: the three internal metatarsal bones articulating with the cuneiform bones, and



BONES OF FOOT.

a, Os calcis; b, astragalus; c, scaphoid; d, cuboid; e, f, g, cuneiform bones; h, metatarsus; i, phalanges.

the two external metatarsal bones articulating as aforesaid with the cuboid. Anteriorly to the metatarsal bones are the *phalanges*, numbering fourteen bones in all, two for the great toe and three for each of the other toes. The bones of the foot are united one to another by strong ligaments, and these ligaments, together with the tendons of muscles which are attached to the bones, serve to maintain the shape of the foot. An examination of an antero-posterior section of a foot shows that the weight of the body, transmitted through the astragalus, is borne by an arch, the hinder portion of which is formed by the os calcis, while the front portion terminates in the balls of the toes. This arch is called the plantar arch. The weakest point in the mechanism of this arch is found to be just below the anterior portion or head of the astragalus. This portion of bone rests upon a ligament which unites the scaphoid with the os calcis, and is further strengthened by the tendon of the posterior tibial muscle (a muscle which winds round the os calcis and passes forward to be inserted into the scaphoid). If the arch gives at all at this point the condition known as *flat-foot* results. The groups of muscles which act upon the foot may be briefly alluded to. The calf muscles act through their tendon (the tendo Achillis) upon the prominence of the os calcis, and when they contract the heel is raised and the toes are brought more or less into line with the lower leg. The muscles which are situated in front of the lower leg, acting through their tendons, elevate, on the other hand, the front of the foot. Thus flexion and extension at the ankle joint are effected, the former being brought about by the muscles of the front of the leg, the latter by the calf muscles. The peronei muscles rotate the foot outwards (abduction), while the tibialis anticus and tibialis posticus rotate it inwards (adduction). The toes are flexed by muscles and tendons running through the sole of the foot, and extended by muscles coursing over the back or dorsum of the foot. It so happens, then, that flexion at the ankle joint and extension of the toes are associated actions, in part brought about by identical muscles situated in the front of the leg, and running over the dorsum of the foot; while similarly extension at the ankle joint and flexion of the toes are effected by muscles situated at the back of the leg and lying beneath (*i.e.* in the sole of) the foot. Beneath the skin of the sole, which is thick and resistant, is a padding of fat, and underneath this again is a strong fascia, the plantar fascia.

2. The foot is the ordinary English unit of length. It is one-third of the standard *yard*, and was taken originally from the length of the human foot. Similarly the French have a unit they call the *pied usuel*, which is a third of the standard *mètre*. This is distinct from the Paris foot, which is about one per cent. smaller. The English foot is divided into 12 inches, and each of these into 12 lines.

Paris foot	=	12.78912 English inches.
Rhenish foot	=	12.35652 "

Foot and Mouth Disease, an infectious disease common in cattle and in rare instances

occurring in man. As the name implies, its most marked symptoms are developed in the neighbourhood of the mouth and feet, where a vesicular eruption manifests itself. On the mucous membrane of the lips and gums, on the tongue, in the interspaces of the front of the foot, and on the udder in cows, little blebs appear. There is an inability to eat, a drivelling of saliva, sometimes heat and swelling of the udder, and lameness. The disorder runs a definite course usually in a week or ten days. The disease is one of those within the scope of the Contagious Diseases (Animals) Acts.

Football, the national winter pastime of England, is an outdoor game, which at the present time may be said to be very nearly, if not quite, the most popular game played. The game has of recent years been divided into two great camps of players, each owing allegiance to two different codes of laws—viz. those of the Rugby Union and those of the Football Association. The chief point of difference is, that in the former game the ball may be picked up and run with at any time, while in the latter no handling of the ball whatever is allowed, and the whole of the work has to be done with the feet.

Under the Rugby Union laws fifteen players on each side take part in the game, distributed as follows: one full back, three three-quarter backs, two half-backs, and nine forwards. The field of play should be 110 yards long and 75 yards broad. At each end are placed two goal posts 18 ft. 6 in. apart, joined by a crossbar 10 feet from the ground, and the object of each side is to kick the ball over this bar of their opponents' goal. The field of play is marked round with a chalk line. When the ball goes over the side lines, called the *touch* lines, it is out of play, and has to be thrown into play at right angles from the touch lines and parallel to the goal lines. A *try* is gained when a player touches the ball down behind his opponents' goal lines. The ball is then brought out straight by a player of the side gaining such *try*, and being placed on the ground, a kick at goal is taken. Should the ball go over the crossbar it counts a goal, and the ball is then kicked off again from the centre of the ground. A player is *offside* when the ball has been kicked by one of his own side who is at the time behind him, and he may not then touch the ball or in any way interrupt or impede any opposing player till he is again on side. A *scrummage* takes place when a player holding the ball in the field of play is *collared* or held. He then has to put it down on the ground in front of him, and all who have closed round on their respective sides endeavour to push their opponents back, and by kicking the ball, or by passing it back to their own side, to kick or carry it in the direction of their opponents' goal. A *drop-kick* is made by letting the ball fall from the hands and kicking it the *very instant* it rises. A goal may be obtained by any kind of kick except a *punt*, which latter is made by letting the ball fall from the hands and kicking it *before* it touches the ground.

If a player wilfully breaks any of the rules of the game, or in the opinion of the referee is guilty

of unfair play, a free kick is awarded to the opposite side.

A match is won by a majority of points. A goal kicked from a try equals 5 points (including the value of the try), a try 3 points. A goal from a drop-kick, or from any other kick except a punt, 4 points, and a penalty goal 3 points. The ball played with is of oval shape, and is made of an inflated bladder covered with leather.

Under the Association laws eleven players a side take part in the game, the disposition in the field of such players being one goal-keeper, two full-backs, three half-backs, and five forwards, two playing on the left wing, two on the right wing, and one in the centre. The limits of the ground vary from a maximum of 200 yards long by 100 broad to half this distance. The goal posts are 8 yards apart with a bar across them 8 feet from the ground. The ball is round, the circumference being 27 to 28 inches, and the weight 13 to 15 ounces. The rules are much simpler than those of the Rugby Union game, the sole object being to kick the ball between the opponents' goal posts and under the bar.

The game is started by a kick from the centre of the ground, the opponents' forwards standing 10 yards back from the ball, till it is so kicked off. If the ball crosses the side touch lines it is out of play, and must be thrown into the field of play by a player of the opposite side to that which kicked it out. The thrower has to face the field of play and throw it over his head with both hands in any direction. With the exception of the goal-keeper no player is allowed to carry, knock, or handle the ball under any pretence whatever. Should he do so, a free kick is allowed against him.

When a player kicks the ball, or throws it in, from touch, any one of the same side who is then nearer to the opponents' goal-line may not touch the ball, or in any way hamper his opponents, until the ball has been played, unless there are at such moment of kicking or throwing at least three of his opponents nearer their own goal-line. A *corner kick* is when the ball has been sent behind their own goal-line by one of the defending side, in which case one of the opposing players shall kick it from one yard of the nearest corner flag-post. Such player endeavours to kick it as near the mouth of his opponents' goal as he can, the other players of his side attempting to rush it between the posts.

Football, generally, is of very ancient origin, and mention is found of it as far back as the reign of Edward II. It was then played in a very rough and primitive fashion by large groups of men, the goals being often some miles apart. Shrove Tuesday appears to have been the great day for these games, and the games played at Chester, Corfe Castle, Scone, and Derby are historical. Many Acts were passed in the reigns of Edward III., Richard II., Henry IV., and Henry VIII., with a view to stamping out the sport; but these appear to have been quite ineffectual, and the game flourished generally in the sixteenth century. Several allusions to the game are to be found in Shakespeare. Tripping, hacking, and rough play

of every description was then allowed, and the game got a very bad name—a character which it has not even yet quite shaken off. The modern Rugby Union game came in its present form from Rugby School, although even the laws there have been very considerably modified. The Rugby Union was started in 1871, and since its institution has done extremely good work in expunging the rules of the game which led to roughness and brute force and changing it into what it now is—a really healthy and scientific pastime. The visit of the New Zealand team in 1905, which met with extraordinary success, greatly revived the interest in Rugby football.

The Football Association was started in 1863. This branch of the game takes its origin almost entirely from the public schools of Eton, Harrow, Westminster, Winchester, and Charterhouse. The scientific nature of the game has been largely elaborated of late years, and the play of the powerful professional teams of the north attracts enormous crowds, and awakens the most intense excitement and enthusiasm. In fact football in the north of England and in Scotland may be said to be now the most popular game played.

Footc. SAMUEL (1720-1777), an English actor and dramatist, was born at Truro. He was educated at Worcester, and afterwards proceeded to Worcester College, Oxford; but he left without a degree. He entered at the Temple, and after getting through a fortune took to the stage, where his first appearance was a failure. His further efforts as a light comedian and buffoon in a kind of society entertainment were successful. Having inherited and dissipated a second fortune he went to Paris, but after two years was back in London, writing. In 1766 he lost his leg partly owing to a kind of practical joke of the Duke of York and others, and this misfortune was to his advantage, for the Duke of York obtained a valuable acting patent for him. He satirised Garrick and Johnson among others, and eventually his satire of a man named Jackson led to his being charged, by way of vengeance, with a criminal offence. He was acquitted, but the accusation broke him down, and he was starting for France in search of health, when he died at Dover. He is buried in the cloister of Westminster Abbey.

Foot-pound is the English engineer's unit of work or of energy. It is equal to the amount of work done when one pound mass is lifted vertically against gravity through a distance of one foot, or when a force equal to one-pound weight is exerted in any direction through one foot. Inasmuch as the force of one-pound weight varies in different localities on the earth's surface, the foot-pound is not an absolute or fixed unit. The absolute unit of work is the foot-poundal, representing the work done in exerting one poundal of force through a distance one foot; the poundal is independent of position, and the unit is thus absolute. The corresponding unit of work, when the centimètre-gramme-second system is taken, is called the *erg* (q.v.), and is the work done by a dyne force moving through one centimètre distance. [DYNÆ.] One

erg is equivalent to 000002373 of a foot-poundal. [ENERGY, WORK.]

Foot-rot, a disease occurring in sheep. The commoner variety consists of an abnormal growth of hoof, which becomes cracked or torn at the extremities or sides, and thus affords lodgment for sand, dirt, etc. In the more troublesome variety the foot is hot, tender, and swollen around the coronet, and there are ulcerations in the interdigital space, with swelling and sprouting of proud flesh.

Foraminifera, a group of Rhizopoda (q.v.) in which the body is protected by a shell or "test," through openings in which numerous fine filaments (pseudopodia) are emitted. The shell is composed either of carbonate of lime, silica, chitin, or grains of sand cemented together by the same chitinous or horny substance. The openings through the shell are either minute and numerous or larger and confined to one particular area or mouth; the pseudopodia are long, and interlace to form a network around the test, which is often completely covered by a layer, formed by the fusion of the bases of the pseudopodia. The protoplasm is uniform and is not differentiated into ectoplasm and endoplasm, as in the *Amœba* (q.v.). A nucleus is, of course, present, and is at first always single: when reproduction is about to take place it subdivides. The shell is the most important structure in the group, and the various classifications proposed have been based upon it. Of these, the most important was one that divided the foraminifera into two groups; the Perforata, and the Imperforata. The former included all those forms in which the test is perforated by numerous minute pores and of which the substance appeared hyaline or glassy. The Imperforata included those in which the shell substance is chitinous, porcellaneous or composed of sand grains, and which is not penetrated by pores, the pseudopodia all issuing at the mouth. It has, however, now been found that such an arrangement is quite artificial, and perforate and imperforate forms are now included in the same family, as in the *Litnolidae*. The test may be simple as in *Orbulina*, or composed of many simple chambers united into a single (polythalamic) individual as *Globigerina*. In many of the complex forms, such as the Nummulites, the separate chambers are separated by an "intermediate skeleton" through which a "canal system" ramifies, and across which various "stolen passages" maintain the connection between the chambers. Most of the Foraminifera have either a straight, coiled, spiral, crozier, or disc-shaped test, but in the arenaceous forms it is often very irregular; thus in the recent *Hyperammina* it is tubular, and in the allied fossil *Girvanella* it is a much-coiled tube. With very rare exceptions, the Foraminifera are all marine; they are universally distributed through the oceans, living on the surface or at great depths. Their tests accumulate at the bottom as a chalky ooze which covers great tracts of the ocean floor at depths of from 250 to 3,000 fathoms. As rock-builders they have played an equally important part in the past, as *Fusulina* in the Carboniferous period, *Globigerina*, etc., in the chalk and

Nummulites in the Eocene have helped to build up great sheets of limestone. The earliest known fossil form occurs in the Ordovician. *Exocoen* (q.v.) was once regarded as an earlier representative of the group, but the theory of its organic origin is now discredited.

Forbes, ALEXANDER PENROSE (1817-1875), was born at Edinburgh, and educated partly at Edinburgh Academy, partly under a private tutor. He entered at Haileybury with a view to preparing for the Indian Civil Service, and proceeded in due course to Madras, but ill-health compelled his return to England. He then entered at Brasenose College, Oxford, and in 1841 obtained the Boden scholarship for Sanskrit. He graduated in 1844, and came under the influence of the High Church movement. He was ordained, and, after serving as curate, was made vicar of St. Saviour's, Leeds, in 1846. In 1847 he became Bishop of Brechin, and ten years later he was proceeded against, and "censured and admonished" for his advanced doctrinal views. He wrote upon the Nicene Creed, the Thirty-nine Articles, and other theological subjects.

Forbes, DUNCAN (1685-1747), was born at or near Culloden, and was educated at Edinburgh and at the University of Leyden. In 1709 he was admitted advocate, and in 1715 exerted himself in the Hanoverian interest. In 1722 he was M.P. for Inverness, in 1725 Lord Advocate, and in 1737 was made Lord President of the Court of Session. He took an active part in the politics of his country, and made strong efforts on behalf of Edinburgh when her privileges were threatened on account of the Porteous riots. In the rising of 1745 he was influential in keeping some of the clans from joining in the movement, and was pointed out by Lord Lovat to Charles Edward as a formidable foe, and he was obliged to take shelter in Skye upon the Prince's advance. His efforts on the side of the Government were hardly appreciated, and money he raised for it is said never to have been returned. He had advised the Government to embody the clans as regiments, but the idea was not adopted till later. He left some writings and correspondence.

Forbes, EDWARD (1815-1854), a naturalist and F.R.S., was born at Douglas in the Isle of Man. As a child he used to make collections in botany and the like. In 1831 he came to London with the idea of adopting painting as a profession, but soon abandoned it and entered as a student of medicine at Edinburgh. From 1833-35 he travelled in Norway, the Isle of Man, Wales, France, Germany, and Switzerland, making scientific researches, and in 1836 attended lectures at the Jardin des Plantes, Paris, and then went to Algiers to study molluscs. In 1838 he travelled in Styria and Carniola; and shortly afterwards lectured in Edinburgh on the natural history of the animals of the British seas. In 1841 he published a *History of British Starfishes*, and the same year he embarked on H.M.S. *Beacon* to explore the botany, zoology, and geology of the

Mediterranean. In 1851 he became Professor of Natural History at the Royal School of Mines in Jermyn Street, and in 1854 was made Professor of Natural History in Edinburgh University.

Forbes, JAMES DAVID (1809-1868), was born in Edinburgh. He was intended by his father, Sir William Forbes, for the bar. His own bent, however, was towards physics, astronomy, and meteorology, and after going to Edinburgh in 1825, he sent a paper upon the *Apparent Number of the Stars* to the *Edinburgh Philosophical Journal*. He made a tour through France, Germany, and Italy, and wrote upon the things he saw. He returned to Edinburgh, and studied moral and natural philosophy, and became F.R.S. of Edinburgh at nineteen. He finally took up Natural Science as his subject, and was much with Sir David Brewster, whom he aided in founding the British Association. In 1833 he was appointed Professor of Natural Philosophy in Edinburgh, and besides filling this post well, he did much for the advancement of the university by introducing the practice of examining for degrees. In 1859 he became Principal of the University of St. Andrews. Besides numerous papers and memoirs on many subjects, he published a *Theory of Glaciers, Travels through the Alps of Savoy, a Tour in Mont Blanc and Monte Rosa, Norway and its Glaciers*, and made many valuable researches into the nature and action of heat.

Forbes, SIR JOHN (1787-1861), was a Scottish physician, born in Banffshire, and educated at Aberdeen and Edinburgh. From 1807-16 he was an assistant-surgeon in the navy, and then graduated at Edinburgh, and lived successively at Penzance, Chichester, and London. He studied and wrote on meteorology and geology, translated a work on auscultation, and introduced the use of the stethoscope, and in 1832-35 collaborated in the *Cyclopedia of Practical Medicine*, besides writing *A Physician's Holiday*. In 1840 he took part in conducting the *Medical Quarterly Review*, retiring in 1859, and eventually dying at Whitechurch. He became F.R.C.P. in 1845, in 1852 honorary D.C.L., and was knighted in 1853.

Forbidden Fruit, a popular name for various fruits belonging to the genus *Citrus*. In the London markets the name is applied to *C. Paradisi*, a small-fruited, smooth-skinned variety of the shaddock, *C. decumana*, also known as "pomelo." In Paris the name, or rather its equivalent, "Pomme d'Adam," belongs to the sweet-skinned orange, a variety of *C. Aurantium*. Italians apply the name "Pomo d'Adamo" to a form of the lime, *C. Limetta*.

Force is that which changes the motion of a body. The study of forces is called *dynamics* (q.v.), and is necessarily very extensive on account of the variety of bodies existent in the universe, and the number of combinations that applied forces can effect in acting thereon. It is usual to add to the definition "that which tends to change the motion of a body," for convenience in distinguishing between force-combinations that change the motion and those that balance each other and produce no resultant motion; but the application of a single extra force to any system in equilibrium will

necessarily disturb that equilibrium, and if a case occur where the extra force brings about a state of balance, the previous condition of the system could not have been one of equilibrium. In other words, a single force must change the state of motion; it cannot merely tend to change that state. A force is measured by the rate at which it can change the amount of motion in a system; otherwise expressed, it is measured by the time-rate of change of momentum. Units of force are so chosen in accordance with this principle; the English *poundal* will give to any mass in one second the momentum possessed by one pound mass moving with a speed of one foot per second; the *dyne* will similarly give in one second the momentum of one gramme mass moving with one centimetre per second speed. English engineers prefer to use the weight of one pound as their unit of force, but it has the disadvantage of varying slightly at different parts of the earth's surface. The exertion of force to produce motion of any body means an expenditure of energy, which is measured by the product of the force and the distance through which it acts. This could be regarded as the fundamental principle for the measurement of force—estimating it as the space-rate of change of energy. Force is not a scalar quality; it is not completely defined by its magnitude, but requires also the statement of its direction, sense, and position. Such quantities are called *rotors* (q.v.), and the laws for their addition, etc., which are studied in quaternions, may be applied to the special case of forces. The application of a force to a given mass must be by means of other matter, though the two substances so involved may not be in actual contact. Newton's third law of motion shows that the action between the two is mutual, that the first body exerts a force on the second that is exactly equal to the force exerted by the second on the first. It is obvious that the duration of application of each of these forces is the same, and that they are opposite in sense. So that the momenta produced by each are equal in magnitude but opposite in sense, and, in fact, their interaction only signifies a redistribution of the same total momentum in the system. That two bodies remote from each other can interchange momentum is a remarkable fact, illustrated readily in the case of gravitation, and demands the existence of some medium between them.

Force-polygon, in graphical statics, means a polygon drawn to scale such that its sides, taken concurrently, represent a set of forces in magnitude, direction, and sense. The forces being in equilibrium, it will be found that the polygon so drawn will be closed, i.e. the application of the last line to the figure, representing the last force in magnitude, direction, and sense, will completely close the figure. If the figure remains open, the forces will not be in equilibrium, but on addition to the system of a force represented to the same scale by the line joining the last point of the diagram to the first, balance may be made to obtain.

Forceps. There are several forms of instrument, with widely different uses, employed in medical

practice to which the term *forceps* is applied. A few of these may be alluded to. For instance, the *extraction forceps* of the dentist are of varying shapes, in accordance with the particular tooth for which each is designed; *pressure forceps* are employed in controlling bleeding by being applied so as to compress the tissues, as they are divided by the knife, in the performance of operations; *bone forceps* are furnished with cutting edges and modelled so as to afford considerable leverage, adapting them for dividing bone; again, there are forceps shaped so as to be used for passing through the nasal passages and into the pharynx, *laryngeal forceps*, *tracheotomy forceps*, and many others. *Midwifery forceps*, which are employed to facilitate the delivery of the head of the child in cases of difficult labour, were first invented by Paul Chamberlen in the 17th century. The discovery was kept a secret for many years—indeed, even in the middle of the 18th century knowledge concerning the new method was confined to a few, and was jealously guarded by them. The construction of the midwifery forceps was considerably improved during the 19th century, and great advances have been made in the science of their application.

Forcible Entry. This is a criminal offence, and consists of an entry or detainer made with such a number of persons or with such apparent force as is calculated to deter the rightful owner from sending the persons away and resuming possession. The offence exceeds a trespass. The entry must, however, have been unlawful to constitute it a criminal offence.

Forcite, a high explosive, is a mixture of nitro-glycerine and cellulose, the latter being first gelatinised by being heated in water under considerable pressure. It is, practically, gelatine dynamite. It is the invention of a Swedish captain, J. M. Lewin.

Ford, JOHN, an English dramatist, was born in North Devon in 1586. He entered at the Middle Temple in 1602; and in 1606 his first work, *Flame's Memorial*, appeared. Besides collaborating in the *Sun's Darling* and other pieces, such as *The Witch of Edmonton* and *The Bristow Merchant*, he wrote *Lover's Melancholy* (1628), *Lady's Trial* (1638), *Broken Heart*, *Love's Sacrifice*, and *Perkin Warbeck*. Though often morbid in his choice and treatment of subjects, Ford was a powerful dramatist.

Fordun, JOHN OF, was a Scottish chronicler of the 14th century, and was a secular priest and canon of Aberdeen. He is said to have travelled on foot in England, Scotland, and Ireland to gather material for his work. The five books which he published of the *Scottichronicon* go down to the death of David I in 1153, but when he died, in 1185, he left material which was used by a later historian. His work is of great value when speaking of contemporary events.

Foreclosure, one of the remedies of a mortgagee, by which the mortgagor's interest in the property (that is, the equity of redemption) is barred and foreclosed and the mortgagee's estate becomes absolute [MORTGAGE.]

Foreign Enlistment, the offence of desertion, or seducing to desert, from the army or navy. These offences are now mainly dealt with by the "Naval Discipline Act, 1866," and the "Army Act, 1881," as amended by the successive annual Acts, by which Acts (when the offender is subject to their provisions) he may be tried by a court-martial, who may inflict such punishment as therein prescribed. In addition, however, to the above there are statutes—passed in the reign of George III.—which enact that any person maliciously endeavouring to seduce any person serving in the Royal forces by sea or land from their allegiance, or stirring up such persons to mutiny or to any traitorous or mutinous practice, shall be guilty of felony. Under these Acts he was made punishable with *death*, but by the effect of later statutes he is now liable, if convicted, to penal servitude for life, or any term not less than five years; or to be imprisoned, with or without hard labour or solitary confinement, for any term not more than two years.

Foreign Law is a question of fact, and by a statute passed in the twenty-fourth year of the reign of Queen Victoria, the High Court of Justice may remit a case with queries to foreign courts of the countries with which a convention shall have been entered into for the purpose by the British Crown, for ascertainment of the foreign law, and may apply the opinion obtained to the facts of the case. But if no convention has been entered into, this Act is inoperative.

Foreland, NORTH AND SOUTH, two promontories on the east coast of Kent, having between them the Goodwin Sands and the sheltered roadstead of the Downs. The North Foreland, said to be identical with Ptolemy's Cantium, is a cliff of nearly 200 feet in height, and has a lighthouse, 85 feet high, showing a light for 20 miles. The South Foreland is 16 miles to the south, and has two fixed lights visible for over 20 miles. In 1666 a four days' sea-fight between Monk and De Ruyter was fought in the neighbourhood.

Forensic Medicine. The frequent combination of medical with legal questions upon inquiries relative to suspected murder, doubtful sanity, and other matters of a like nature, has given rise to a sort of mixed science known as *forensic medicine* or *medical jurisprudence*, which may be considered as common ground to legal and medical practitioners, for it teaches the application of every branch of medical knowledge to the purposes of the law; hence its limits are, on the one hand, the requirements of the law, and, on the other, the whole range of medicine. Forensic medicine is also occasionally required in cases of a civil nature, such as questions of lunacy, or unsoundness of mind, or cases of nuisances injurious to health. It is, however, more frequently in requisition in criminal trials, where the evidence of an expert is frequently required. Thus, in a trial for murder, where the evidence is circumstantial, it is almost always necessary to adduce evidence by a medical practitioner as to the appearance of the body, and the results of a post-mortem

examination. So far as he attempts to account for the symptoms or appearances observed by him, his evidence is merely opinionative. (See the works of Taylor, Guy, Beck, and Tidy, on this subject.)

Foreshortening, in drawing or painting, is the representation in correct perspective of an object presented obliquely to the eye, the effect aimed at being to make the object appear as if projecting from the canvas.

Forest Fly, a small brown fly, about a third of an inch in length, which is parasitic on the horse. It creeps about on the belly, and is extremely irritating. Its scientific name is *Hippobosca equina*.

Forest Law. The right of keeping animals in a wild state for mere diversion, though forbidden to the subject, has been at all times admitted as a matter of prerogative to the Sovereign. A forest, though a Royal possession, is capable of being vested in a subject, for if the Sovereign grants a forest to a private person, with words expressly authorising the administration of forest law there, the grantee will have the franchise of a forest to its full extent, with all the appropriate courts and officers; and a forest is a right which the owner thereof (whether Sovereign or subject) may have either in his own lands or in the lands of another, and in this respect it differs from a right of common, which issues out of the soil and cannot exist in the same man who is owner of the soil itself (the latter superseding all inferior claims of this kind); but a forest, and indeed all franchises in general, are inheritances collateral to the proprietorship of the land, and may be claimed by a man either in *proprio solo*, or in *alieno solo*. The owner of a forest is also considered (notwithstanding the general rule, that title cannot be made to things *feræ-naturæ*) as having a qualified property in the wild animals of chase and venery there found, so long as they continue there; and no other person can lawfully take them within those precincts, or chase them from thence and take them in other ground. But if a wild animal strays from the forest, it seems to be the property of the owner of the franchise, and will belong to the first taker. [COMMON.]

Forestry, the science and art of the management of forests. It is sometimes divided into arboriculture (q.v.), which treats of plantations, and silviculture (q.v.), which deals with natural forests. It studies the conditions best adapted to tree growth and the climatic results of such growth; the protection of forests from injuries; their exploitation or realisation at the period of maturity; their renewal, whether by seeding or planting; their restoration after periods of neglect; the utilisation of their products; and the legitimate increase in the revenue derived from them. The study depends, therefore, largely upon vegetable physiology, but borrows also from systematic and structural botany, meteorology and political economy, and, to some extent, from chemistry, geology, and entomology. The chief direct effects of forests upon climate are (1) screening the soil from the sun's rays; (2) exposing an immense leaf-surface for the cooling process of radiation; and

(3) giving off moisture in evaporation. Indirectly, these actions secure greater equability of temperature, humidity, and rainfall, and so regulate the flow of rivers, prevent floods, and maintain springs. In Europe at the present time Russia has 40 per cent. of its area under forest; Norway and Sweden, 34; Austria, 29; Germany, 26; Italy and the Balkan peninsula, 22; Switzerland, 18; France, 17; Spain, Belgium, Holland, and Great Britain, 4; and Denmark, 3. Even in Russia the plentiful supply of timber is only in the north, and in Norway and Sweden the supply shows itself to be by no means inexhaustible. The wasteful destruction of forests in the United States, Canada, India, and many other countries has not only threatened in many cases the future supply of timber, but in some countries has seriously affected the water-supply. Forests supply timber, fuel, material for paper, and a variety of valuable substances such as cork, bark for tanning, gums, dyes, drugs, and articles of food. For both climatic and economic reasons, therefore, it has been urged that forests should be preserved by valuation-surveys and working-plans, by the prohibition of cutting immature trees, by the replacement of mature trees by seedlings, and by the establishment of nurseries for this purpose. The increase in value of maturing timber may be gauged from the consideration that annual rings of wood, if assumed to be of equal width, vary in sectional area in the series 1, 4, 9, 16, 25, etc., giving an annual gain of 3, 5, 7, 9, etc., whilst at the same time the trees are gaining in height and the timber is increasing in quality and, from its size, in value per cubic foot. In Britain trees are generally felled by selection, so that several ages are left upon one area; or coppice (q.v.) with selected "standards" is adopted; or the whole wood when mature is felled and replanted. On the Continent it is the rule to fell by rotation of area, all the trees in each area being of one age; and natural seeding or reproduction is generally relied on to replace the crop. The re-afforestation (*reboisement*) of districts denuded of forests is often, as in the case of Ireland, a matter of national importance. On steep slopes it may have a great effect in checking the removal of the surface-soil by rain, and the landward march of the sand-dunes of the Landes of Bordeaux has been checked by planting the maritime pine. The prevention of forest fires and the checking the ravages of the various fungoid and insect enemies of forest trees are special subjects of the forester's study. On many estates in Scotland the woodlands are under a responsible keeper or forester, but in England their maintenance is in the hands of land-agents. England, not suffering from deficient rainfall and supplied with cheap foreign timber, has neglected the study of forestry more than all other European countries.

Forfar, county town and royal and parliamentary borough of the Montrose group, Forfarshire, in the Vale of Strathmore, at the east end of a small loch. David I., in the 12th century, made it a royal borough, and the market day was formerly Sunday. The site of the old castle is now

occupied by a market cross. Among the chief buildings are a courthouse, townhall, a public hall, county buildings, and several schools, and an infirmary. The principal trade is the manufacture of linen, and there are several factories and bleach-works. Brewing and tanning also are carried on. Population (1901), 11,397.

Forfarshire, or **ANGUS**, a county on the east coast of Scotland, having Aberdeen and Kincardine on the N., Perth on the W., the Firth of Tay on the S., and the German Ocean on the E. It is 36 miles long by 30 miles in breadth, and contains 568,750 acres. In the N. and N.W. lies a part of the Grampians, called the Braes of Angus, and rising to a height of 2,600 feet, and in the S. a part of the Sidlaw Hills rises to a height of 1,400 feet. Between these hills lies the Vale of Strathmore, while between the Sidlaw Hills and the Tay is the fertile Carse of Gowrie. The principal rivers are the North and South Esk. The county is highly farmed, and produces good wheat, oats, barley, potatoes, and turnips. Much cattle-rearing is carried on. In most of the towns coarse linen is manufactured, Dundee being the centre of the linen and jute trade. Flagstones are quarried in the Arbroath district, and limestone and slate are worked to a small extent. The county returns one member to Parliament. Population (1901), 284,082.

Forfeiture. Forfeiture occurred under the feudal system where the tenant committed some act, or omitted some duty in violation of the compact with his lord, such as rendered him unfit to be longer trusted as a vassal. Forfeiture, in modern times, takes place where a tenant grants a larger estate than his own, or where a tenant for life or years assumes to convey the fee simple, or where a lessee commits a breach of any of the covenants in the lease, etc. Also if a copyholder commit waste, or refuses to do suit of court, or a lessee impugns the title of his lessor, the right to take advantage of a forfeiture may be waived by any act of the person entitled which recognises the continuance of the title in the particular tenancy, as, for instance, the receipt of rent by a landlord in respect of a time subsequent to the act of forfeiture. Forfeiture, as between landlord and tenant, has been much restricted, and relief therefrom given by statutes passed during the reign of Queen Victoria.

Forficulids. [EARWIGS.]

Forge is a furnace employed by smiths in the working of iron and steel. *Forgings* are pieces of wrought-iron or steel that have been worked up to shape, and are ready for further treatment with cutting or other tools.

Forgery. Legal forgery is the false making, counterfeiting, altering, or uttering any instrument, or writing with a fraudulent intent, whereby another may be defrauded. The offence is complete by the making the forged instrument with a fraudulent intent, though it be not published or uttered, and the publishing or uttering of the instrument, knowing it to be forged, is punished in the same manner as the making or counterfeiting. It is not now necessary to constitute forgery that the

name of any person should be counterfeited, though this is the most common way in which the crime is committed. Anyone is guilty of forgery who antedates a deed for the purpose of defrauding other parties, though he sign his own name to the instrument, and it is forgery if a man, being instructed to make the will of another, inserts provisions on his own authority. The offence consists in the fraud and deceit. Under the Statute 24 and 25 Vict. c. 98, and numerous other statutes, offences analogous to forgery at common law are made felonies, and are punishable as forgeries; but that punishment is not death as formerly, but penal servitude for life, or for any term not less than five years, or imprisonment with or without hard labour, and with or without solitary confinement, for any term not exceeding two years. The Forged Transfers Act, 1891, enables, but does not oblige, companies and local authorities to make compensation "by a cash payment out of their funds, for any loss arising from a transfer" of their shares, stocks, or securities, "in pursuance of a forged transfer, or of a transfer under a forged power of attorney."

Forget-me-not, a name formerly applied by our unpoetical ancestors to the ground-pine (*Ajuga Chamapitys*), a labiate plant so rich in turpentine that, if once tasted, it will not soon be forgotten. In quite modern times we have imported the German legend of a knight who was drowned in endeavouring to gather for his lady-love some flowers of the beautiful water scorpion-grass (*Myosotis palustris*)—one of the least hairy plants in the Borage family—transferring to this plant his dying words, "*Vergiss-mein-nicht*" (forget-me-not).

Forlì (Lat. *Forum Livii*), a province and town of Northern Italy, formerly belonging to the States of the Church. The province contains 716 square miles, and has in the W. some low spurs of the Apennines, while in the N. it is flat, and there are malarious swamps along the coast. The chief productions are corn, hemp, flax, madder, saffron, anise, wine, olives, and fruit. Bees and silkworms are reared, and the fisheries are good. Sulphur occurs in great abundance, and is an article of export. The railway from Milan to Ancona passes through the province. The town lies in a fertile plain between the Montone and Ronce rivers, and is 50 miles S.E. of Bologna. It is well built, with broad streets and a central square.

Forlorn Hope, a military term signifying the body of men selected to plant a scaling ladder on a fortress or to be the first to make a breach. It is derived by Professor Skeat from the Dutch *verloren hoop* (pron. *hope*), or "lost band." Similarly the French give the term *enfants perdus* ("lost boys") to the leaders of a storming party.

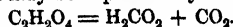
Formaldehyde (formic or methyl aldehyde, or oxymethylene, CH_2O) is the first of the series of compounds known as *aldehydes* (q.v.). It is an unstable substance only existing as a gas or in dilute solutions, and is formed by the oxidation of methyl alcohol (CH_3O). It readily polymerises (i.e. forms more complex molecules of same percentage composition), yielding *paraformaldehyde*

$(\text{CH}_2\text{O})_n$, a white solid melting at 171°C . It also changes into a polymer *trioxymethylene* $(\text{CH}_2\text{O})_3$, which melts at 60°C . It is noteworthy that from these polymers by a remarkable series of reactions, many of the sugars have been artificially prepared, and in connection with this also, the fact that formaldehyde is found in plant cells which contain chlorophyll seems one of interest.

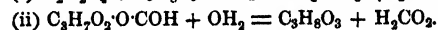
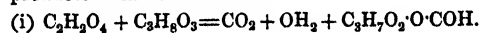
Formentera, one of the Balearic Isles (q.v.); its length is 13 miles, and breadth from 2 to 10 miles. It has a population of about 2,000.

Formes, KARL (1810-1874), a German bass singer, was born at Mülheim, and first made his mark in the *Zauberflöte* in 1842 at Cologne. He sang at Vienna and in England and America.

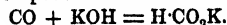
Formic Acid, the first of the series of fatty acids; it hence has the formula $\text{H}\cdot\text{COOH}$. As in the case of the first compound of many series of organic substances, it differs in many respects from the other members. It is found in stinging nettles, in pine shoots, and in ants (hence the name from *formica*, an ant), and may be prepared artificially by a number of reactions. The usual method, is to heat oxalic acid with glycerine; the latter substance, however, does not undergo any final change. The reaction may be expressed by the equation



The action of the glycerine in assisting the reaction is probably due to the formation of intermediate products as indicated thus:—



An interesting formation of this acid is the direct synthesis of its salts by the action of carbon monoxide upon potash at 100° .



It is a mobile liquid of specific gravity 1.2, which boils at 99° , and becomes crystalline at 0°C . It blisters the skin, and has a strong pungent odour. It forms a hydrate with water, with which also it mixes in all proportions. It is decomposed by sulphuric acid into CO (carbon monoxide) and OH_2 (water). It acts as a strong reducing agent, precipitating silver or mercury from solutions of the salts of these metals.

Formicidae. [ANTS.]

Formosa. 1. An island of the Chinese Sea and province of the Chinese Empire, is separated by a strait of 80 miles and upward in breadth from the mainland province of Fokien. It is 250 miles long by 70 miles broad, and contains 15,000 square miles. The western part of it consists of wide fertile plains, which produce bananas, oranges, rice, corn, pepper, sugar, tea, tobacco, cinnamon, and camphor. The principal exports are camphor, coal, hemp, indigo, sugar, tea, and timber. There are four treaty ports, among them being Taiwan, the capital. A railway runs from Port Ke-lung to the tea-fields. The eastern part of the island is claimed by Japan. Formosa is inhabited by two distinct races, the uncivilised aborigines of the central and eastern uplands, who are of Malay stock, and the

civilised Chinese intruders, chiefly from the province of Fokien, on the western plains. Intermediate between these two are the *Pepohoans*, that is, the semi-civilised natives of the western slopes, some of whom, such as the Tsuihoans of the Lake Tsui-sia-hai district and the Sekhoans of the Posia valley, have attained a somewhat high degree of culture, placing them on a level with their Chinese neighbours. But the *Sang-fan* ("wild men") of the interior and the east coast are almost unanimously described by the few travellers that have come in contact with them as exceedingly fierce and treacherous savages at a very low stage of culture. T. L. Bullock, who visited the Boo-hoans and others in 1876, speaks of them as ferocious head-hunters, like the Bornean Dyaks, who attack stealthily in bands, kill for the mere love of bloodshed, and carry off as trophies the heads of their victims. The Song-miau, Hu-lu, and Mow-tau are also mentioned by J. H. Gray as "fierce and inhuman tribes," and the same character is borne by the Kweijing, Tailokok, Komalan, Peplos, Kall, and other east coast tribes, who are much dreaded by mariners wrecked on that dangerous sea-board. Christianity has made considerable progress amongst the Pepohoans, and the people of the Posia valley are now nearly all converted, though the neighbouring Chinese settlers still remain Buddhists.

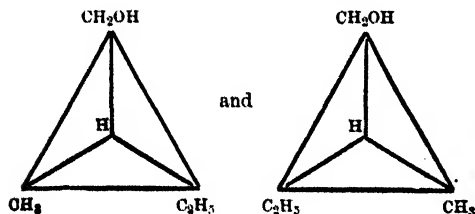
2. An Atlantic island off the west coast of Africa, 30 miles long by 18 miles wide, fertile and well-wooded.

Formose, a compound of composition $\text{C}_2\text{H}_{12}\text{O}_8$, which was prepared by Loew in 1885 by the condensation of *oxymethylene* by means of magnesia. [FORMALDEHYDE.] It appears to be a mixture of different sugars, and its preparation is important as a starting-point in the synthesis of these compounds, which has within recent years been successfully accomplished.

Formula, in general *Physics*, is an equation which will determine the magnitude of some physical quantity, when proper numerical data are known and applied. Similarly, in pure mathematics, a formula means the equation connecting a variable quantity with those upon which its value depends.

Formula. In *Chemistry*, the use of symbols to represent chemical substances is one of early date. The alchemists employed the various zodiacal signs and those of the planets to represent the various metals with which they were acquainted. Thus silver was represented by the sign of the crescent moon, ☾; copper by the symbol of the planet Venus, ♀, etc. At the end of the 16th century it was proposed to represent the metals by circles containing the first letter of their Latin name, thus Ⓢ = iron, while oxygen was to be represented by a horizontal line, and other elements by various geometrical figures. This met with the approval of the great French chemist, Lavoisier, but not of chemists generally, and in 1808 Dalton proposed to represent, by various signs, *atoms* of the elements. In his system an atom of hydrogen was represented by Ⓜ, an atom of oxygen by O, of nitrogen by Ⓝ, etc.;

and by placing together these symbols he proposed to build up chemical formulae. The simpler notation in use at present, introduced by Berzelius, prevented Dalton's notation from being adopted. In this, the first letter or characteristic letters of the Latin name signifies an atom of the element (or weight proportional to the atomic weight) and the number of atoms (or such quantities) are indicated by a small figure placed to the side of the symbol and generally below. The formula, hence, expresses the proportional composition of a substance and also, where possible, its molecular weight and complexity. Thus *acetylene* is written C_2H_2 , not CH , because its vapour density shows that the molecule has the more complex composition. In many cases, however, when the vapour density cannot be determined, the molecular complexity is not known, and here the formula expresses solely the proportions in which the various elements are present in the compound. In such a case the simplest formula is taken which expresses this proportional composition. The attempt to go further in the use of formulae, and to express the *constitution* of bodies, met with much opposition from many chemists, who regarded it as impossible to determine the mode in which the elements are united. In organic chemistry, however, such *constitutional formulae* are very largely employed. Thus two substances, ethyl or ordinary alcohol and methyl ether have the same composition formula, C_2H_5O , whilst the vapour densities show this represents the complexity. They differ, however, widely in their properties, the ether being a gas which is only liquefied at very low temperatures, while the alcohol is a liquid boiling at $78^\circ C$. All the reactions of the latter indicates that it contains a group of elements, or radical, C_2H_5 ; while in the case of the former there are present two separate groups, CH_3 . The alcohol, therefore, receives the formula $C_2H_5.OH$, while $(CH_3)_2O$ is that ascribed to the methyl ether; formulae completely justified by all the reactions of the bodies and their relation to other substances. In some cases, however, the use of such constitutional formulae is insufficient to completely define a substance. Thus two *amyl alcohols* exist, both of which must be represented by the formula $\begin{smallmatrix} CH_3 \\ C_5H_{11} \end{smallmatrix} : CH.C_2H_4OH$, but which differ in one respect: one is *laevo-rotatory*, the other *dextro-rotatory*. [POLARISATION.] To explain differences of this nature, van't Hoff and Le Bel proposed the use of tridimensional formulae, in which the difference of the arrangement of the atoms in space accounts for the difference in the behaviour. Thus, in a case above, the compounds would be represented by



in which the tetrahedron is simply employed to indicate the spatial position of the groups, a carbon atom being supposed to occupy the position of the centre of the tetrahedron. The difference between the two formulae, it is noticed, is exactly similar to that between any object and its image. The application of these formulae has within recent years been attended with very great success, and the theory has been very largely extended by Wislicenus and others.

Forres, a parliamentary borough of the Inverness group, in the county of Elgin, and 25 miles N.E. of Inverness. It is clean, well-paved, and has good buildings. In the old castle Duncan was killed, and close by is the heath upon which Macbeth and Banquo met the witches. A monument, called Swend's Stone, is said to commemorate a victory over the Danes. Population (1901), 4,313.

Forrest, EDWIN (1806-1875), an American actor, was born in Philadelphia. In 1820 he first appeared as Douglas in Horne's tragedy. A few years later he played Othello at New York, and in 1836-37 he played in London. In 1845 his *Macbeth* was hissed, and in return he is said to have hissed Macready. In 1849 he was the cause of the Astor Place riot in New York, jealousy of Macready again being the determining motive. From 1853 to 1860 he was in retirement, but again came forward at New York, and was successful. His after efforts, however, were in a great measure failures.

Forrest, RIGHT HON. SIR JOHN (b. 1847), was an explorer of Western Australia. He belonged to the Survey Department, and in 1869 set out from Perth in a N.E. direction, and reached long. $123^\circ E.$, lat. $29^\circ S.$, through a barren country of salt marsh and bush. In 1870 he surveyed along the S. coast, and in 1874 along the E. He was the first Premier (1890-1901) of Western Australia under responsible government, but relinquished office to join the Commonwealth Government, under which he has held several important positions.

Forster, FRIEDRICH (1791-1868), a German man of letters, was born at Münchengosserstätt. He first studied theology at Jena, and then devoted himself to art and literature. In 1813 he joined the army and became captain, and was for a time professor at the School of Engineering and Artillery at Berlin. He then subscribed to literary journals, and made a tour in Italy, and later received an appointment in the Royal Museum at Berlin. Among the subjects he treated of were *Frederick the Great* and *Frederick William I.*, and he wrote poems and an historic drama. He also published an edition of Hegel and some adaptations of Shakespeare.

Forster, JOHANN GEORG (1754-1794), a German naturalist and man of science, was born at Dantzig. In 1765 he went with his father to inspect some Russian colonies, but the father offended the Russian authorities, and they left Russia and came to England. Both father and son accompanied Captain Cook upon his third voyage. Johann was afterwards professor at Cassel, but appears to have had peculiar views both in politics and other

matters. He afterwards went to Wilna, and then to Russia, finally settling down at Mayence as first librarian to the Elector. When the French Revolution broke out and the French entered Mayence, he was sent by the republicans of Mayence as a deputy to Paris. While he was away the city was retaken by the Prussians, and he lost all his books, papers, and other property. He died in Paris. Among his writings were *An Account of Cook's Voyage, Travels in the Netherlands and the Rhine Land*, besides essays on geography, philosophy, etc. He is considered a classic in Germany, and there is a great freshness about his style.

Forster, JOHN (1812-1876), English historian and man of letters, was born at Newcastle, and educated at the grammar school there. He came to London in 1828, and soon began to write for the Liberal papers, and was appointed literary and dramatic critic of the *Examiner*. His *Lives of Eminent British Statesmen* gained him an entry into the best literary circles. In 1843 he was called to the bar. In 1846 he edited the *Daily News* for some months, and from 1847 to 1856 the *Examiner*. Besides contributing many articles to different periodicals, he wrote a *Life of Oliver Goldsmith* (1848), *Biography of Sir John Elliot* (1864), *Biography of Walter Savage Landor* (1868), his well-known *Life of Charles Dickens* (1871-74), and the first volume of a *Life of Swift* (1875). He was for some time a Commissioner in Lunacy.

Forster, WILLIAM EDWARD (1819-1886), was born at Bradford, and was educated at the Friends' School, Tottenham, then entered a woollen factory in his native town. In 1845, at the time of the Irish famine, he went over to distribute a relief fund raised by his co-religionists. In 1850 he married Miss Jane Arnold, the eldest daughter of Dr. Arnold of Rugby, and in 1861 he was returned to Parliament for Bradford. In 1865-66 he was Under-Secretary for the Colonies, and in 1868 he was made a Privy Councillor and Vice-President of the Committee on Education. In 1870 he entered the Cabinet, and produced his celebrated Elementary Education Bill, which worked a revolution in English educational ideas. His refusal to abandon entirely the voluntary system began the estrangement between himself and the section of Radicals headed by Mr. Chamberlain, which lasted through the rest of his life. In 1872 he had charge of the Ballot Bill. In 1874, on Mr. Gladstone's retirement from the Liberal leadership, he was offered the post, but refused it. In the same year he visited the United States, and in the following year he was made Lord Rector of Aberdeen University. In 1880 he was appointed Chief Secretary for Ireland, and this appointment gradually led to a divergence of views between himself and his chief. Although he approved greatly of the idea of Imperial Federation, he was opposed to the granting Ireland a Parliament; and his being the instrument for carrying out a policy of coercion made him obnoxious to a large section of Irishmen. On the release of the Irish suspects in 1882 he resigned his post. He had narrowly escaped murder at the hands of the Irish Invin-

cibles. That his fellow-townsmen had confidence in him is shown by the fact of their electing him in his absence in 1885. He was a man of decided views and opinions and great firmness of character, and was respected by both sides of the House, and probably, except in moments of irritation, by his Irish opponents. A statue of him has been placed upon the Thames Embankment in memory of his educational work; and there is a life of him, in two volumes, by Sir Wemyss Reid.

Fortescue, SIR JOHN (14th century), an English lawyer, was born in Somerset, and educated at Exeter College, Oxford. After going to the bar, he became a governor of Lincoln's Inn, was created Sergeant in 1441, and Lord Chief Justice in 1442, a post which he retained for Henry VI.'s life. He was loyal to the House of Lancaster, and in 1463 he shared the exile of Margaret and Edward, writing his *De Laudibus Legum Angliæ* for the Prince's benefit. In 1471 he received a general pardon from Edward IV. Other works of his are extant.

Forth, a river and estuary of Scotland, formed by the junction of the Duchray and the Dhu, rising in Stirlingshire and Perthshire respectively. The junction is at Aberfoyle—of Nicol Jarvie fame—and after forming the boundary for some distance between Stirlingshire and Perthshire, the river opens out into a broad firth reaching the German Ocean after a course of 170 miles. It flows through a rich country, and through the Links of Forth it winds greatly, the distance between Stirling Bridge and Alloa being 6 miles by land and 12 by water. One of the peculiar features of the river is a curious double tide. The Forth Bridge [BRIDGE] is one of the greatest engineering triumphs of our day. The river has good salmon, and the estuary has white fish, herrings, and oysters. The Firth narrows at Queen's Ferry—named after Margaret, wife of Malcolm Canmore—and this is supposed, from the Roman remains in the neighbourhood, to have been the Roman "Freti transitus." In mid-channel is Inchgarvie, on which are the ruins of a 16th century castle erected to protect the shipping in St. Margaret's Hope just west of the Ferry, which is the greatest natural harbour for refuge on the east coast of Scotland. In the Civil War a Captain Roy blew up the magazine to keep it out of Cromwell's hands, and in 1779 it was put in repair on account of Paul Jones's raids on the coast. The river is only about a mile across at the ferry, and the Inch reduces the passage on each side to less than 600 yards. There are two lighthouses. The river receives several tributaries.

Fortification. [MINES, SIEGES, RAVELINS, MILITARY ENGINEERING.]

Fortiguerra, NICCOLO (1674-1735), an Italian prelate and poet, born at Pistoja. His chief work was an epic poem called *Ricciardetto*, in thirty cantos, which takes great liberties with history, but displays much keen satire. This may have been the poet's reason for postponing its publication till after his death. He also wrote short poems and sonnets.

Fortuna, the Roman goddess of "luck," corresponding with the Greek Tyche. Some represent

her as a daughter of Oceanus, others as a sister of the Fates, and she is represented with various emblems, the most usual being a wheel. Her worship prevailed in Etruria, and she had a temple at Antium with two oracular statues, a temple at Preneste, and twenty-six temples at Rome. She is sometimes represented with wings, and Horace makes allusion to these.

Fortunatus, the title of an old German *Volksbuch*, dating from the 15th century, the oldest printed edition being of the date 1509. The story is that Fortunatus and his sons have an inexhaustible purse (*Seckel*) and a wishing-cap (*Wunschhütlein*), which, instead of making them completely happy, ultimately cause their ruin; the moral being that wealth is not all-sufficient. Versions of it in French, Italian, Dutch, Danish, Swedish, and Icelandic have appeared; and it was dramatised by Hans Sachs and Thomas Dekker (*Pleasant Comedy of Old Fortunatus*).

Fortune, ROBERT (1813-1880), botanist, was born at Berwick. He began life as a gardener, and was employed at the Royal Botanical Gardens at Edinburgh, and then in the gardens at Chiswick. In 1843 the Botanical Society of London sent him to China, and in 1847 was published his *Three Years' Wanderings in Northern China*. He made three more visits to the country in the tea interest, and took plants to India, and collected seeds and plants for the United States of America. He made a fifth journey, and wrote *Yedo and Peking* in 1863. Other works of his are a *Journey to the Tea-countries of China*, and *Residence among the Chinese*.

Fortuny, CARLO MURIANO Y (1839-1874), a Spanish painter, went to Morocco with the Spanish army, and took the opportunity of making studies in Oriental subjects. His *Battle of Tetuan* is at Barcelona; his preference was for Oriental life pictures, and he made many etchings of Oriental subjects. Among his paintings are *The Spanish Marriage*, a *Bibliophile in Richelieu's Library*, and *Academicians choosing a Model*.

Fort Wayne, the capital of Allen county, Indiana, United States of America. It is situated in a picturesque district, at the junction of St. Mary's and St. Joseph's rivers, which unite to form the Maumee. It is the seat of a Roman Catholic bishopric, and has many churches, and several newspapers.

Fort William, a town in the county of Inverness, at the foot of Ben Nevis, and at the S. end of the Caledonian Canal, E. of Loch Linnhe. The fort was built by Monk in 1655, and was rebuilt in 1689, and is still used as a dwelling-house. The town, known at different periods as Maryburgh and Gordonsburgh, is pleasantly situated, and a great centre for tourists.

Forty appears to have been regarded by mankind as a sacred number, particularly by the Jews and the Mahometans. To cite some instances: the Flood lasted 40 days; Moses fasted 40 days on three occasions (Exod. xxiv. 18, xxxiv. 28; Deut. ix. 9-25), as did Joseph after the death of his

father; Christ was tempted for a similar period. The Israelites were in the wilderness 40 years. Mahometans mourn 40 days for their dead; and in Eastern romance the number is of frequent occurrence. In the *Arabian Nights* we have the Forty Thieves, and Aladdin is given the same number of days to find the lamp. In *Nasir*, a Persian tale, the hero is to pray 40 days for the restoration of the fairies' fountain; and he shoots an arrow through a finger-ring 40 successive times. For 40 days Shah Mansur was in the power of a sorceress; and in *Ahmed the Cobbler* the treasury is robbed by 40 men. In Wales it was customary to pay 40 loaves and 40 dishes of butter as rent to the Bishop of Llandaff; and a bard's fee was 40 pence if a disciple, and twice that sum if a master. *The Heir of Linne*, in the ballad, tries to borrow 40 pence from John o' the Scales.

Forum. The word signifies an open space, and is connected probably with *foris* = out of doors (cf. *supra*, and door). The Forum Romanum (called later *magnum* or *vetus*) lay between the Palatine, the Capitoline, and the Quirinal hills. It was originally a swamp; and the memory of this fact was preserved by the legend of the Lacus Curtius (Livy, i. 12). When drained it was set apart for the administration of justice. It included the *comitium*, where the *curiæ* or patrician house met, which was separated by the Rostra, or platforms, from the meeting-place of the plebeian assembly or *comitia tributa*. The word Forum was sometimes applied to this latter space alone. In the period between Julius Cæsar and Trajan five additional *fora* were made. The sites of various markets at Rome also bore this name.

Foscari, FRANCESCO, Doge of Venice, born in the latter part of the 14th century, was elected in the 15th century. He waged successful wars against the Turks, and against Visconti, Duke of Milan. In 1443 he was in league with Sforza, Duke of Milan, against Alfonso of Naples and the Pope, and his three sons died in the service. His fourth son, Jacopo, was accused of taking bribes and of treachery, and was tortured and exiled. Having escaped, he was sent back, and the father was deposed through the machinations of a rival, and died broken-hearted. Their history forms the subject of Byron's tragedy, *The Two Foscari*.

Foscolo, UGO (c. 1776-1827), an Italian prose author and poet, was born at sea, and educated at the university of Padua. His *Thyestes* was produced at Venice just before the fall of the republic, and on the Austrian ascendancy he went to Rome, where, in 1802, he published *Ultime Lettere di Jacopo Ortis*. His style is good, but tinged with sadness and melancholy. In 1803 he published a satire. He went to Paris, and, returning to Milan in 1807, he produced a poem *Dei Sepolcri*, and two tragedies, *Rienciardi* and *Ajace*. Ordered to quit Milan, he went to Mantua, where he lived till the abdication of Napoleon, and translated Sterne's *Sentimental Journey*. Owing to his ideas upon Italian independence, he had again to leave the country, and went to Switzerland, Russia, and, in 1815, to England, where he finally died in poor

circumstances at Turnham Green. He wrote *Notes on Dante*, and *An Essay on Petrarch*.

Fossa, the ditch surrounding a Roman camp. Its breadth varied according to circumstances from five to nine or even thirteen feet, its depth from three to thirteen feet.

Fossil, a term, originally including mineral specimens, now restricted to "any body, or the traces of the existence of any body, animal or vegetable, buried in the earth by natural causes." Thus worm-burrows, the cast, external or internal, of a shell, footprints, or the amber from a tree, are as much fossils as the bones, stem, or leaves themselves. No question of age enters into the definition, fossils being the remains either of extinct organisms or of those now living, which are termed "recent." Nor is there now any necessary notion of mineral change implied in the term. The original substance may be wholly or partly preserved, as in the case of the mammoths (q.v.) found frozen entire in Siberia or the little altered chitinous coverings of Palæozoic trilobites and scorpions; or only the external or internal form may be retained with no internal structure; or the original substance may have been molecularly replaced by true *petrification*, so that the minutest internal structure is preserved, as in silicified wood. The expression "natural causes" is introduced into the definition to exclude the intentional burial of remains by man and so to delimit the province of archaeology from that of geology. The study of fossils is termed *palæontology* (q.v.). Organic remains are seldom preserved as fossils unless speedily protected from air. Birds, insects, and other animals, or plants, that perish on dry land stand little chance, therefore, of preservation; whilst peat-moss vegetation, and aquatic animals, together with those entombed in caves or by mineral springs, are far better represented in the "geological record." Again, it is, as a rule, only hard parts that are preserved, such as the woody stems, leaf-veins and harder fruits of plants, and the calcareous shells, chitinous integuments, bones and teeth of animals. The chief mineral substances that replace the organic matter in fossilisation are calcite, aragonite, silica, mostly as opal, marcasite, chalybite, and less commonly glauconite, vivianite, native copper, fluor, etc. Fossils are important from three points of view: (1) Biologically, as evidencing the former existence of organisms forming series of forms ancestral to those now existing; (2) geographically, as evidencing former differences in the distribution of land and water and climate; and (3) geologically, as affording the chief means for the identification of stratified rocks in distant localities and tracing their chronological succession. [GEOLOGY, HOMOTAXIS.]

Foster, JOHN, an English essayist (1770-1843), was born near Halifax, and after a sombre, gloomy childhood was sent to the Baptist College at Bristol. He was not very successful as a minister, and lived successively at Newcastle-on-Tyne, Dublin, Chichester, Bristol, Frome, and died at Stapleton, near Bristol. He published a volume of essays in 1806, the best-known of them being, perhaps, that on

Decision of Character. Among other works are *An Essay on Popular Ignorance* (1820).

Foster, STEPHEN COLLIN (1826-1864), an American song-writer, was born in Pennsylvania, and was in business at Cincinnati. Of his earlier songs, which were of the kind known as negro minstrelsy, *Uncle Ned*, *O Susanna*, and *Old Folks at Home* are examples. At a later period he produced others, which were coloured by the saddened circumstances of his life. Among these later songs are *Old Dog Tray*, *Willie, we have missed You*, and *Come where my Love lies Dreaming*.

Fothergill's Process, a process used for the formation of a photographic dry plate. The method was (1) to coat a glass plate with collodion containing dissolved nitrate of silver, and (2) pour over the coated plate a solution of albumen containing sal-ammoniac (NH_4Cl) dissolved in it, and then allow the plate to dry.

Foucault, JEAN BERNARD (1819-1868), a French physicist, was born at Paris. He studied medicine, but afterwards gave himself to physical science. He made improvements upon Daguerre's methods in photography, and made researches into the sun's light, polarisation, binocular vision, the passage of light through air and water, and the use of the pendulum in ascertaining the diurnal motion of the earth. [FOUCAULT PENDULUM.]

Foucault Currents, in *Electricity*, are eddy-currents set up in the iron cores of armatures, etc., which are useless in increasing the available current for the external circuit, and which may damage the insulation of the parts of the structure by heating up the metal. They may be reduced by making the iron core in thin segments or discs, that shall not offer continuous mass of metal in the direction in which the eddy tends to flow, and yet shall be continuous in the direction of the lines of force that require to be conducted through the core. [DYNAMO.]

Foucault Pendulum, an instrument designed to demonstrate the rotation of the earth about its axis. A long fine wire supports a massive metal sphere or pendulum-bob, which is set swinging in any one vertical plane. It tends to stay in that plane, and the rotation of the earth will, by leaving it behind, cause the pendulum to appear to rotate its plane of swinging. The wire should be at least twenty feet long; the first swing should be produced by pulling the bob away from the vertical with a piece of thread, and then burning the thread; and the bob should be heavy enough to carry the motion on for an hour or more. These precautions being taken, the apparent change of plane of oscillation will be rendered evident.

Foucault's Experiment. [LIGHT.]

Fouché, JOSEPH, DUC D'OTRANTO (1763-1820), was born at Nantes, and was educated there and at Paris. He taught philosophy at Nantes, and after the Revolution, being then an advocate, he was returned to the Convention as member for the Loire Inférieure. He was on the Committee of Education, and took part in the atrocities of Collot

d'Herbois at Lyons. In 1795 he was expelled from the Convention and imprisoned, but in 1798 was sent as ambassador to Milan, and the next year in the same capacity to Holland. He was recalled and put at the head of the police, and aided Napoleon in the overthrow of the Directory. Dismissed for a time, he resumed office in 1804, and was also made Minister of the Interior. In 1810, Napoleon, who distrusted him, sent him into honourable exile at Rome, but he afterwards returned and lived as a private citizen. In 1813 Napoleon sent for him at Dresden, and the Bourbons would have kept him on in his office had he not resigned after their refusing to follow his advice of granting a general amnesty. When Napoleon was at Elba he declined the royal offer of the headship of police, but accepted a similar offer from Napoleon, who, however, still showed distrust of him. After the fall of Napoleon, Fouché arranged the terms of the capitulation of Paris, and sent the French army beyond the Loire. He became Minister of Police to Louis XVIII., but, finding himself in a position of difficulty, resigned and went abroad, finally dying at Prague.

Fougha (*Beni-Fughal*), a large Kabyle (Berber) tribe of the province of Constantine, Algeria, some sixteen miles south-west of Jijelli. They occupy the densely-wooded slopes enclosing the Wed Misia Valley, and formerly enjoyed special privileges as owners of the surrounding oak and cedar forests, whence the Algerian corsairs derived the materials for their fleets. Such was the value of these forests that, in return for the right of working them, the Government granted to the Foughas concessions of vast arable and pastoral lands in the district extending as far as the neighbourhood of Guelma, which still bears the name of Beni-Fughal. Most of the peasantry in this region belong to the Fougha tribe, which at present numbers altogether nearly 20,000 souls.

Fould, ACHILLE (1800-1867), French financier and politician, was the son of a Jewish banker at Paris. In 1824 he became deputy for the Hautes-Pyrénées. He approved the Revolution of 1848, and was appointed Minister of Finance. He wrote a pamphlet, *Las d'Assignat*, and, approving of the *coup d'état*, was, at intervals, Finance Minister of the Empire.

Foundation, the substructure upon which all erections are built. Its nature will depend on the soil underneath, being as a rule much simpler in construction when the soil is good firm ground. Rock should be tested in solidity and thickness, and foundations built square thereon. Gravel or hard clay is good if of sufficient thickness and if compressed with rammers. Loose ground must be strengthened artificially. Concrete is much used as a basis, especially over compressible soils, upon which the footings are laid and the structure raised. Piles may also be driven in to support the foundations; they are specially desirable when the structure adjoins the sea, river, or marsh, and are then planted so as to prevent lateral yielding of the subsoil. Submarine foundations may be prepared by simply dropping large boulders in the sea

in suitable positions, but the more systematic method of using caissons or coffer-dams (q.v.) is now much employed for the construction of foundations under water.

Foundation Sacrifice, a kind of human sacrifice, in which the victim was buried beneath, or his blood poured over, the foundation-stone of a building to appease the ground spirits and render them protectors of the new building. In some cases, however, the victim was walled up, in the way the Scots herd-boy described to Hugh Miller (*My Schools*, ch. xi.) how the man "was killed on the foundation-stone, just after it was laid, and then built into the wa' by the masons." The custom seems to have been kept up in Europe till the Middle Ages, a beast being generally substituted for a human victim. It still lingers in the East, and was possibly known to the Semites (Joshua vi. 26).

Founding is the art of casting molten metal in moulds. It is not applicable to all metals, requiring that the temperature of melting shall not be inconveniently high, that the molten liquid shall flow readily into the mould and fill up all the corners, and that it shall disengage air-bubbles and solidify into a uniform homogeneous mass. Such properties distinguish the different compounds of iron with carbon, and, while giving the name to *cast-iron*, they render wrought-iron incapable of such treatment and steel either the one or the other, according as the proportion of carbon it contains renders it similar to cast-iron or to wrought-iron. Copper and aluminium cannot be cast, but bronze or gun-metal, which are both alloys of copper and tin, make excellent castings. So also will the bronzes containing phosphorus, aluminium, or ferro-manganese, which are respectively named phosphor-bronze, aluminium-bronze, and manganese-bronze. The other characteristic properties of these alloys render their capability of being cast highly useful in engineering. Cast-iron parts are formed by melting the *pig-iron* (q.v.) in a *cupola*, heated strongly by means of a forced draught, running the metal out of the bottom of the furnace through small gates into a clay-lined wrought-iron ladle, and pouring it into moulds of the requisite shape and size. *Patterns* are made of yellow pine, or in special cases of mahogany or metal; they are made about one-eighth of an inch to the foot larger than the required casting to allow for contraction of the metal on cooling. *Moulds* are then prepared from the patterns in loam or foundry sand; hollows in the castings require special *cores* of loam in the moulds. The molten iron is then poured in, and, after it has solidified, the sand is cleared away and the casting removed. Although castings may be much more complex in form than wrought work, yet if they are badly designed stresses may be produced in them when they cool down from the liquid condition, and they may be so weakened as to fracture with much readiness. On this account sharp angles are to be avoided, all corners being much stronger when well rounded. Thin parts in continuation of thicker parts are liable to solidify first,

and may be fractured later on when the thicker material contracts and solidifies. Much depends then on good design, though many difficulties are overcome by skilful founding. Very rapid cooling of the molten metal is effected by the use of moulds of cast-iron lined with loam. The result of this is that separation of graphite from the iron is prevented; it becomes extremely hard and much more brittle. Such is the nature of *chilled castings*. A reverse effect is produced by keeping the casting for a day or two at high temperature in contact with iron-oxide; the surface then partakes of the nature of wrought-iron, and the casting will stand blows much better than before. Bubbles of gas in the molten liquid must be eliminated before the metal cools. Small holes are made in the mould to allow their exit. Whitworth introduced casting of steel under pressure to prevent the formation of bubbles, and to render the metal denser and stronger. Bronze-founding has been practised for ages. The Colossus of Rhodes was a brass casting, about 100 feet high. A specimen of bronze-work still exists at Constantinople, that was cast some 500 years B.C. It is a pillar formed of three twisted serpents, originally 20 feet high. Modern specimens of bronze-founding show no great advance in excellence of workmanship. The most famous are the "Bavaria" national statue at Munich, 67 feet high; the "Arminius," 90 feet; the "Vierge du Puy," 51 feet; the "Germania," 112 feet; and Bartholdi's "Liberty," 156 feet. The general method of casting is closely similar to that employed in iron-founding. Small bronzes are most beautifully produced by the *cire-perdue* process, known to the ancients. The essential principle is that of using a wax-covered pattern, which can receive all the refinements from the artists' hands. It is embedded in a clay mould; the wax is removed by heating and allowing it to escape, and the molten bronze is then poured into the hollow thus left.

Foundling Hospitals are places where deserted children are received and brought up from funds provided either by charitable individuals or by some public body. The first institution of the kind was established at Milan at the end of the 8th century. Others soon sprung up in Germany, Italy, and France. Of these the Foundling Hospital of Paris is perhaps the most remarkable. Marguerite de Valois had, in 1536, established a home for the *enfants trouvés* who were left in the porch of Notre Dame; a tax for their maintenance had been set apart later; and another home, called the *Couche*, had been founded by the Bishop of Paris. Great evils, however, attended the management of the last, which were in part remedied by the efforts of St. Vincent de Paul (q.v.). Soon after the foundation of the Paris Hospital, the *Couche* was amalgamated with it, and Marguerite de Valois's orphanage was joined to both in 1772. The Revolutionary Government declared all *enfants trouvés* "children of the country," and encouraged the reception of them by the offer of a premium to all women who declared themselves mothers of illegitimate children. Under existing regulations

the Paris Hospital receives not only foundlings, but those whose parents are known, as well as destitute orphans, and also incorrigible children (*enfants moralement abandonnés*). After a few days the infants are boarded out with peasants or artisans, the Government granting a subsidy up to their twelfth year, from which time till they come of age they remain under the surveillance of provincial inspectors. Wet-nurses and presents are also sent out by the institution to mothers who need them. Parents may reclaim their children on giving satisfactory proof of their identity; and the adoption of children whose parents are unknown is allowed under satisfactory conditions. Foundlings are now known as *enfants assistés* at Paris. Of these, the annual number provided for by the hospital is about 4,000; that of the incorrigibles about 1,200. Savings-banks have been established for both. The Foundling Hospital of London owes its existence to Captain Thomas Coram, and is supported by voluntary private contributions. It receives only the illegitimate children of mothers who have previously borne a good character. Of these there are about 500; some are boarded out in the country. Of those who live in the hospital, the girls become domestic servants when they are 14, and the boys go into trade or the army at 16. In Russia the Moscow Foundling Hospital accommodates 13,000 children per annum, and that of St. Petersburg 7,500. Special care is taken with the rearing of prematurely born infants. The regulations are very lax. There are similar institutions in New York, Rio de Janeiro, Buenos Ayres, and China. Mortality has been very large in some founding hospitals. When the Dublin Institution was closed in 1835, the death-rate was 4 in 5; in Russia it has frequently been from 50 to 60 per cent.; and at Vienna has been as high as 75. In France and London it now stands at less than 4 per cent.

Fountain, a spring of water. The term is commonly confined to springs, which, whether natural or artificial in themselves, have been in some manner ornamented through human art. The adornment of such objects of common use arose naturally with the growth of city life, and was further promoted by the reverence felt for springs, each of which was believed to be the haunt of some protecting deity. The ancient Greek and Roman fountains, described by Pausanias and Vitruvius respectively, were formed either by covering a spring over, to keep the water fresh and cool, or by placing a cistern at some distance from the ground and allowing a jet to play from it into an artificial basin. Those of the former kind, common in Greece, were decorated with a statue of the deity to whom the spring was sacred, or sculpture representing some mythological subject, either within or outside the stonework of the fountain. At Rome the water often flowed from the bronze statue of a Triton, Nereid, or other fabulous creature. Many fountains of this kind have been discovered at Pompeii. The public fountains furnished the ordinary water supply both among the Greeks and Romans, though the more wealthy inhabitants of

Rome had pipes leading to their own houses. In either case the water was conveyed to the city through the great aqueducts. Medieval fountains originated in the same manner as those of the ancient world. Springs had held an important place in the element-worship of Celts and Teutons; when Christianity drove out Paganism they became fountains dedicated to the Madonna or one of the saints. These varied considerably in form. A common pattern was that of a square, round, and polygonal basin, in the centre of which was a column, whence spouts issued at intervals, so that several persons could fill their vessels at the same time. Some of these fountains are perfectly plain, while others are decorated with niches for figures of saints and other Gothic ornaments. As sanitary science progresses, and greater attention is paid to the purity of the water-supply, fountains cease to serve any but an ornamental purpose. Among the most famous ornamental fountains are those at Versailles and at the Crystal Palace, Sydenham. Fine effects are now produced by allowing the jets of a fountain to play on sheets of plate-glass, covering a chamber illuminated by the electric-light; pieces of glass of various tints are then introduced between the jets and the light beneath them, and these are changed at the same time that the height and combination of the jets is altered, so as to cause an infinite variety of movement and colour.

Fountains Abbey, in the West Riding of Yorkshire, three miles S.W. of Ripon, is one of the best specimens of a ruined abbey to be found in England. It is said to have been founded in 1114—a year after the foundation of Rievaulx—by Cistercian monks, who were expelled from St. Mary's, York, and built some wooden cells under a huge elm. The abbey eventually became wealthy, and the buildings were added to at different periods, and so exhibit a great variety of architecture. There are fragments of the gate-house, the hospitium, the nave, transept, choir, and tower of 168 feet, and a beautiful Lady Chapel, with slender, octagonal pillars of considerable height, bearing lofty arches, which are connected with the clerestory of the nave. There are also remains of refectory, chapter-house, and abbot's house. By the spring, which is supposed to have originated the name of the abbey, Robin Hood fought with the curial friar.

Fouqué, HEINRICH, BARON DE LA MOTTE (1777–1843), a German author, was born at Brandenburg, and served as a lieutenant in the Prussian Guards, rising, after some years of intervening retirement, to major. He afterwards went to Paris, and then lived on his estate, and died at Berlin. Though he wrote some poetry, he is chiefly known by his prose, his best-known works being *Aslan's Knight, Sintram and his Companions*, and *Undino*. This last has been widely translated, and has been dramatised, and is a wonderfully pretty example of imaginative mysticism. The weirdly allegorical story of Sintram has also many admirers.

Fouquet, NICOLAS (1615–1680), a French financier, born of a good Breton family. In 1650 he was made *procureur-général*, and in 1653 *surintendant*

des finances as a reward for his loyalty in the struggle with the Fronde. He was afterwards, however, accused of wasting and devoting to his own purposes the public funds, one special accusation being that he employed 18 millions in building a château for himself. The king, spurred on by Colbert and jealous of certain alleged pretensions upon Fouquet's part towards Louise de la Vallière, allowed him to be arrested and tried before a commission, the result of the trial—which lasted four years—being a lifelong imprisonment. La Fontaine, Madame de Sévigné, and others vainly pleaded for Fouquet.

Fouquier - Tinville, ANTOINE QUENTIN (1747–1795), one of the most repulsive figures of the Reign of Terror, was born at Héronelles. He entered with zeal into the Revolution, and much pleased Robespierre, who obtained for him the post of Public Accuser. He seemed mad for blood, and besides compassing the death of thousands of royalists, and preparing the disgraceful articles of accusation against Marie Antoinette, he was prepared to guillotine Robespierre and all his colleagues. He was finally guillotined himself, and displayed great want of courage at his execution.

Fourier, FRANÇOIS MARIE CHARLES (1772–1837), a noted French Socialistic theoriser, was born at Besançon. His father left him a small fortune, and he embarked in business first at Rouen and then at Lyons. During the Revolution he was a conscript. Afterwards in business employ at Marseilles, he took a disgust for trade, and determined to give all his attention to forming Socialistic plans. His idea of Phalansteries, in which each man's natural inclination (aided by emulation and sexual sentiment), was to determine his work, and each should work for the common good, without, however, the dead level of equal interest and equal property, is set forth in his treatise upon *L'Association Domestique Agricole*. Eventually he became insane. Though many of his schemes were wildly absurd, he was among the first to observe the great benefits of co-operation and the concentration of industry. Unsuccessful attempts were made in France and America to carry out his views.

Fourier, JEAN BAPTISTE (1768–1830), a French mathematician, was born at Auxerre, and educated at the military school there, becoming a teacher in it at eighteen. He then taught at Paris, and followed Napoleon to Egypt, where he did some political work, and wrote an introduction to the *Description de l'Egypte*. In 1802 he drained some marshes in the department of Isère where he was prefect. In 1815 he became a member of the Academy of Sciences, and later was made life-secretary of it. Among his works were an *Analytical Theory of Heat*, a *Theory of Equations*, and *Analysis of Determinate Equations*, and a treatise upon *Terrestrial Heat* and that of planets.

Fourier Series offer a method of analysing any irregular curve and determining simple harmonic constituents that shall, within any assigned limits, combine to produce the curve. This is the

geometrical representation of the problem, which has, however, a far-reaching application in the higher branches of physical science. To take one example, the irregular distribution of heat conducted from the surface of the earth to the interior may, by means of the Fourier series principle, be analysed into a number of simple harmonic distributions. [HARMONIC.]

Fowl. [POULTRY].

Fowler, Sir John, born 1817 at Sheffield, was a noted civil engineer. He took part in the construction of the London, Brighton, and South Coast Railway, the Underground Railway, and in river and dock works, and was knighted in 1885 for services in Egypt. In connection with Sir Benjamin Baker he constructed the Forth Bridge. He died in 1898.

Fowler's Solution (*Liquor arsenicalis*), an important pharmacopoeial preparation made by boiling arsenious acid and carbonate of potassium in water, and then adding compound tincture of lavender. It is highly poisonous, but is very useful in small doses in certain skin diseases and in some forms of dyspepsia.

Fox, any species of the Alopecoid, or Vulpine, section of the family Canidae, sometimes made a separate genus (*Vulpes*), but generally included in the genus *Canis*, from the typical members of which the Alopecoids differ chiefly in some minor characters of the skull and dentition, and in their more elongated body. The pupil is generally oblique, the muzzle pointed, and the tail bushy; but this last character is also possessed by the South American dogs, which have wolf-like skulls. Foxes are widely distributed, chiefly in the northern hemisphere, but none are found in South America. The common fox of Europe (*Canis vulpes* = *Vulpes alopec*) either as we know it, or under more or less well-marked varieties, some of which have been elevated to specific rank (*Proc. Zool. Soc.*, 1887, p. 635), has nearly the range of the family. The average length is nearly four feet, of which the tail takes up more than a quarter. The legs are slender, and the long lank body is thickly covered with reddish-brown hair, which makes the animal look larger than it really is. There is some white on the under surface, the ears and toes are black, and black hairs occur plentifully in the tail, the tip of which is mostly white. Foxes are solitary, nocturnal animals, generally living in burrows or "earths," with several exits. They rarely excavate a burrow for themselves, but drive out rabbits or badgers from their holes, though they are said sometimes to share a retreat with these last-named animals. Occasionally they make a dwelling under rocks or stones. They often lie in cover in woods; and a vixen (for so the bitch-fox is called) has been known to whelp under a rick-saddle in a farmyard. Little of an animal nature comes amiss to foxes in the way of food. Their principal diet consists of hares, rabbits, partridges, poultry, and occasionally young lambs, though they do not disdain rats, mice, and frogs. They eat putrid meat readily, and in some cases are said to resort to the seashore to

feed on molluscs and crustaceans. Foxes pair early in the year; the period of gestation is about nine weeks. The cubs attain full size in eighteen months, and the duration of life is said to be thirteen or fourteen years. Foxes are not easily domesticated; but when taken young they have been tamed (*see Field*, October 8th, 1892), but their strong smell renders them anything but agreeable pets. The cunning of the fox is proverbial, and it was one of the first animals in which the habit of feigning death as a means of escape from danger was noticed. The skin is valuable for its fur, and on this account foxes are shot and trapped without mercy everywhere except in England, where to kill a fox except in orthodox fashion with horn and hound is little short of a crime. [FOX-HUNTING.] The difference between the British and the American fox (*C. fulvus*) is very slight; but the latter has the tail covered with soft fur uniformly mixed with long hair. In the grey fox (*C. virginianus*) and the shore fox (*C. littoralis*), also American forms, there is a ridge of stiff hairs on the upper line of the tail, and by some writers they are on this account made a separate genus (*Urocyon*). The Asiatic species are about three feet long, and the African forms still smaller. [FENNEC.] The habitat of the Arctic fox (*C. lagopus*) is indicated by its distinguishing epithet. It is about three feet long, of which the tail counts for a foot, with a very bushy tail, and the soles of the feet are thickly furred. It was long the custom to cite this animal as a good instance of protective coloration, the fur being said to be greyish-blue in summer, changing to white in winter; but Dr. Robert Brown asserts that the blue and the white foxes are distinct varieties, and the colour is totally independent of the season. These animals are cleanly in habit, and playful in disposition. They feed on mice and lemmings, and when food is plentiful hide it in the snow for a future day. The blue skins are more valuable than the white.

Fox, Charles James (1749-1806), one of the most eminent statesmen and politicians of the end of the 18th and beginning of the 19th centuries. His father, Lord Holland, while indulging him in all his whims, took care of his education, and sent him to Eton, where the boy became a good classic, and wrote good Latin and Greek. From Eton the youth went to Oxford, and before he was of age he sat in Parliament for Midhurst, and in 1770 was a lord of the Admiralty, and a commissioner of the Treasury in 1772. In the early part of his career he voted chiefly according to his father's wishes, but later he became independent, and a disagreement with Lord North sent him into opposition. When the American War of Independence broke out, he joined with Burke in opposing and speaking against it. In 1780 he was elected to represent the city of Westminster, and he became Secretary of State in Lord Rockingham's Government. When Lord Rockingham died Pitt left the Government, and Fox formed, with Lord North, the coalition which led to his temporary unpopularity. When Pitt was in power, Fox headed a strong opposition, and fought hard over the Regency Bill, but Pitt won the day.

In 1790 Fox regained the popularity he had lost, by opposing the idea of war with Spain and Russia, and by supporting the rights of juries in his Libel Bill. The breaking out of the French Revolution brought about an estrangement with Burke, who publicly renounced Fox's friendship. Fox opposed the war party, and supported Mr. Addington in concluding the Peace of Amiens in 1801, but acquiesced in the war on becoming Lord Grenville's Foreign Secretary. His death followed closely upon that of Pitt. Though hardly the equal of Pitt, Burke, and others in eloquence, Fox was an able speaker and debater, and had a manly, telling style of delivery. The charm of his personal character made him a general favourite.

Fox, GEORGE (1624-1690), the founder of the sect of Friends, was born at Drayton in Leicestershire. In his youth he tended sheep, and the solitary nature of his life gave him a great tendency towards meditation. It was at the age of nineteen that he felt a Divine call to give up all for religion, and in 1648 he began to preach in Manchester and the neighbourhood; but it was in Derby that the derisive name of Quakers was bestowed on his followers, though the Society was not formed till 1666. Fox met with much persecution at the hands of local authorities. In 1665 he was confined in Scarborough Castle, and he tells us how, in one of the rooms facing the sea, "the wind drove in the rain forcibly, so that water came over his head and ran about the room, so that he was fain to skim it up with a platter." His travels and labours and imprisonments broke his health in his latter years. He travelled in Wales, Scotland, Barbadoes, Jamaica, Holland, and Germany, and recorded his experiences in his *Journal*. He wrote (besides the *Journal*) *Epistles*, and *Doctrinal Pieces*.

Fox, RICHARD, an English fifteenth-century prelate, who filled at one time or another four bishoprics. He was born near Grantham, and educated at Magdalen College, Oxford, at Cambridge, and at Paris. In Paris he was introduced to the future Henry VII. of England, and upon the king's accession he was made a privy councillor and much employed, and became finally Bishop of Winchester. The king appointed him an executor of his will, and recommended him to Henry VIII. The new king, however, did not much like him, and he was soon outstripped in influence by Wolsey, whom he had introduced to the king. His later life was passed in retirement, and during this period he founded Corpus Christi College, Oxford.

Foxe, JOHN (1517-1587), Church historian, was born at Boston in Lincolnshire. He was entered at Brasenose College, Oxford, and in 1543 became Fellow of Magdalen, which society expelled him for heresy in 1545. In Queen Mary's reign he went to Basel, and corrected the press for a printer there. In Elizabeth's reign he returned to England, and received a pension from the Duke of Norfolk. He was also a prebendary of Salisbury. In 1575 he pleaded with the queen on behalf of persecuted Dutch Anabaptists. His *History of the Acts and Monuments of the Church*, commonly called 'the

Book of Martyrs, was first printed in 1563, and has passed through many editions.

Foxglove (*Digitalis purpurea*), the only British species of a genus of Scrophulariaceæ. It is biennial; has an erect stem 3 to 4 feet high, covered with grey down; scattered downy leaves; and a terminal bracteate raceme of pendulous monosymmetrical campanulate flowers. The corolla is rose-colour, or, rarely, cream-colour, with dark spots and light-coloured hairs inside; the didynamous stamens are within the tube; and the fruit is a many-seeded capsule. The whole plant contains a poisonous substance known as *digitalin*, which reduces the heart's action. The dried leaves are employed in medicine as a sedative and diuretic in dropsy and heart-disease; but large doses cause vomiting, purging, and fainting, and may prove fatal. It was introduced into medicine by the botanist Withering in 1785. The plant is commonly cultivated for the beauty of its flowers. It is the badge of the Farquharson clan.

Foxhound, a breed of dogs used in England for hunting foxes, and generally supposed to be descended from the Old English Hound, with a large admixture of greyhound blood to give the necessary speed—the powers of scent, tongue, and endurance being derived from the original stock. Breeding on definite principles seems to have been carried on early in the 17th century, though it was not till much later that the breed became fixed. The height of a foxhound at the shoulder is from 22 in. to 24 in.; the head should be large, with a deep muzzle and long rounded ears, the back short and well developed, the legs muscular, the feet round with well-arched toes, and the tail nearly straight. The fur is short, and the colour is white, with a greater or less amount of black, or black-and-tan markings.

Fox-hunting, as a sport, has been carried on for about 200 years. Before that time foxes were treated as vermin. [Fox.] They were driven into nets or run to earth and dug out. A certain Mr. Roper seems to have been the first "huntsman." He managed a pack of foxhounds for the Duke of Monmouth and Lord Grey, and afterwards, with the Duke of Bolton, owned another. His death, in 1715, actually took place in the hunting-field. Among the earlier established hunts were the Charlton, the Brocklesby, and the Sinnington. The Belvoir pack dates from 1740, and the Pytchley from 1750; and Sir Philip Jennings hunted foxes in the New Forest about the same time. In early days the hunting "countries" were much larger than at present, one of them (the Berkeley) extending from Bristol to London. Hounds used to meet soon after daylight and track the fox by means of the line he had taken on returning from his search for food. The time of meeting is now usually about 11.0 a.m. The fox is drawn from cover, has a little time to get away before the halloo is given by the whipper-in, and is then run. Much depends on the "scent," which is very uncertain. A hunt consists of a master, or committee; a huntsman, who, if he is a professional, has the management

of the kennels; one or two whippers-in, a stud-groom to superintend the stables, and various feeders and helpers. Gamekeepers are given a reward for stopping "earthts." The Duke of Beaufort, Sir Watkin Wynn, and other masters undertake the whole expense connected with their pack; but a subscription of the hunt is more general. A special fund is set apart for compensation to those whose poultry have been injured by foxes. In 1909 there were 170 packs of foxhounds in England and Wales, and 35 in Scotland. The cost of keeping a pack of hounds is very considerable. Cub-hunting begins soon after harvest, and regular fox-hunting lasts from about November 1st to April 1st. The sport has been introduced in India, where the Peshawur Vale hounds and those of the Maharajah of Mysore are the chief packs; in Canada (Montreal) and Manitoba, and also at the Cape, in Bechuanaland, New Zealand, and Cyprus. In Florida the fox is hunted by moonlight. There is a volume on Hunting in the Badminton Library, written by the Duke of Beaufort and Mr. Mowbray Morris.

Fox Indians (OUTTAGAUMIE), a western branch of the Algonquian family, who have long been associated with the kindred Sacs (Sauks). After the expulsion of the latter from the Upper St. Lawrence river by the Iroquois, they escaped westwards along the southern shores of the great lakes; but, being still pursued by their implacable enemies, they withdrew to the Green Bay district, Lake Michigan. Here they were joined by the Foxes from the Upper Mississippi, and soon after the two confederate tribes established themselves in the Rock River Valley. Later they were removed by the American Government, some to Iowa, some to Indian Territory. The latter, reduced, according to Flemming, to less than a hundred in 1889, have hitherto rejected all civilising influences, while those of Iowa, numbering about 500 in Tama and Toledo counties, have abandoned most of their tribal usages and become peaceful agriculturists. In 1891 the reserve of the Sacs and Foxes, E. of Oklahoma in Indian Territory, was thrown open to colonisation, so that this division of the two allied tribes may now be regarded as extinct or absorbed in the general population.

Fox Shark (*Alopias vulpes*), the single species of the genus, occurring sometimes on the British coast, and common in the Atlantic, some parts of the Pacific, and in the Mediterranean. The maximum length is 15 feet, of which half is taken up by the caudal fin, which has the upper lobe enormously prolonged. The teeth are of moderate size, anal and second dorsal small, pectorals and first dorsals large. These fish prey upon herrings, pilchards, and sprats, and from their beating the water with their tail to frighten their prey, they are often called Threshers. There is no foundation for the story that they attack whales.

Fox Terrier, a breed of white hound-marked terriers, used to drive foxes from their earths, or to give notice by barking as to where Reynard is so that the diggers-out may dislodge him. They are also capital vermin-killers, and from their

intelligence and good temper are highly valued as companions. The height at the shoulder should be about 14 in., and the weight from 17 lbs. to 20 lbs. The head should be flat and narrow, with clean-cut jaw, black nose, small eyes full of fire, and V-shaped ears carried close to the cheek, the neck clean and muscular, shoulders long and sloping back, chest deep, and narrow rather than broad; back, loins, and hind quarters very strong, and forelegs straight when viewed in any direction. The coat, whether smooth or wire-haired, should be close and abundant.

Foy, MAXIMILIEN SÉBASTIEN (1775-1825), a French general and politician, was born at Ham. Joining the army in 1791, he fought in the Army of the North, and later distinguished himself in the Rhine and Moselle campaigns. In 1801 he commanded the vanguard of the army of Italy, in 1805 commanded artillery in Austria, and in 1807 went to Turkey to oppose the British and Russians. He then fought with distinction in the Peninsula, and as commander of a division received his fifteenth wound at Waterloo. In 1819 he was returned as deputy for the Aisne department, and distinguished himself as a speaker. He was a Liberal in politics, and a great advocate of civil liberty. Some of his speeches have been published, and his wife wrote a history of the Peninsular War from his papers.

Foyers, FALLS OF, are two cataracts in Inverness-shire on the river Foyers, $2\frac{1}{2}$ miles from the spot where it falls into Loch Ness. The upper fall is about 30 feet high, and the lower about 90, and the glen, through which the falls pass, has wild and romantic scenery. Old Edie Ochiltree speaks of the tide round Halket Head running like the Falls of Foyers.

Fracastoro, GIROLAMO (1483-1553), a poet of the Renaissance, was born at Verona. His chief work was a poem in Latin, *Syphilis*, dedicated to Cardinal Bembo, and he wrote a later one on the patriarch Joseph. He has been sometimes ranked next to Virgil. Another poem is *Alcon; sive de Cura Canum Venaticorum*. He also wrote in prose upon sympathy and antipathy, and upon contagion and contagious diseases.

Fraction, in the theory of numbers, means same portion of any unit or of any multiple of that unit. Regarding in arithmetic 1 as our fundamental unit, any portion thereof is called a fraction; so also is any portion of any multiple of 1, if expressed as such. Any portion less than unity is called a *proper* fraction; any portion greater than unity, an *improper* fraction. There are two methods of denoting fractions in arithmetic—the one on the Vulgar Fraction system, the other on the Decimal Fraction system. The former writes the multiple of the unit just above the number of equal parts into which that multiple is divided to represent the given fraction. The upper number is called the *numerator*, and the lower the *denominator*. Thus, $\frac{1}{12}$ means one of the twelve equal parts into which unity itself may be divided; $\frac{1}{113}$ means one of the 355 equal parts into which the quantity represented by 113 units may be divided; and similarly for the

fraction $\frac{113}{355}$. In this last case 355 is the numerator, and 113 the denominator. The improper fraction $\frac{113}{355}$ will be found identical with 2 units, and it may thus be seen that any number, whether whole or otherwise, may be regarded as fractional; and the former may therefore, in the event of their presence among ordinary fractions, be submitted to the same arithmetical processes as the latter. It should further be noticed that $\frac{113}{355}$ represents 113 of the 355 equal parts into which unity may be divided. This is a different notion to that involved in the definition, and requires to be deduced therefrom before its truth can be assumed. Decimal fractions are such that the number of parts, into which unity or its multiples are divided, are always powers of 10, such as 10, 100, or 1000. Thus, $\frac{379}{1000}$ is a decimal fraction, though it is usually written in the form .379, the fact that the denominator is 1000 being signified by the *decimal-point* being placed directly in front of the 379. [For the rule concerning the position of the point, see DECIMAL FRACTIONS.] In algebra exactly the same ideas hold, but decimal notation is impossible unless the quantities are known numerically. Hence the Vulgar Fraction notation is used, and the expression $\frac{a}{b}$ may be readily interpreted. The applications of fractional forms may be much extended by introducing fractional values of numerator and denominator. No meaning at first attaches to the expression $\frac{2\frac{1}{2}}{7\frac{1}{2}}$, for we cannot conceive of the number $2\frac{1}{2}$ being divided into $7\frac{1}{2}$ equal parts. Nevertheless, in simpler fractions it is seen that multiplication of numerator and denominator together by the same number does not alter the fraction; and, assuming this law to hold true generally, the above fraction should not alter if the two terms in it are multiplied by 6. This gives its value $\frac{1}{3}$, the meaning of which is more obvious.

Fractional Distillation. [DISTILLATION.]

Fractures (Latin *frango, fractum*, to break), the breaking of a bone into two or more fragments. A fracture may be *simple*, when there is no track of communication between the broken bone and the surface; *compound*, when such a communication exists; *complicated*, when the injury producing the fracture causes some associated mischief, such as a dislocation, to result. Other terms are employed to describe certain fractures. A *comminuted* fracture, of course, implies that the bone is broken up into several fragments; a *greenstick* fracture signifies that the bone is broken in the same way as when a green stick is snapped across the knee. (This form only occurs in the soft and yielding bones of children.) Fractures may be produced by *direct* or by *indirect* violence. In the former case, as a result of a blow, the bone gives way at the point struck; in the latter the bone is subjected to the influence of two or more opposing forces, and gives way at its weakest point. A fracture may be produced by sudden muscular contraction, apart from any external injury; for example, the patella is sometimes broken when a man attempts to save himself from falling, the extensor muscles of the

thigh being suddenly put into action. There are certain conditions which predispose to fracture. Rickets and scurvy render the bones unduly fragile; again, the pliable bones of children are much less readily broken than are the brittle bones of advancing life. Fractures are much more common in men than in women.

Symptoms. These are pain, swelling, deformity, inability to move the injured parts, and in some cases the existence of unnatural mobility at the site of injury, and finally *crepitus*. This last is the most important of all the symptoms of fracture, but it is not invariably present. The peculiar grating sensation, which is elicited when the two broken ends of the bone rub one against the other, is quite unmistakable by the surgeon. The bones in which fracture most commonly occurs are the clavicle, the radius at its lower end (Colles' fracture), the femur, the fibula (Pott's fracture), and the ribs. The repair of a fracture is brought about by the effusion of lymph, which occurs at the site of injury, and which envelopes the broken ends of the bone, and gradually becomes infiltrated with calcareous salts and then ossified. The effused inflammatory material is called *callus*. When the two ends of the bone are not steaded, an excessive amount of this callus (*provisional callus*) is at first thrown out, and some of it is subsequently absorbed, what remains being termed *permanent callus*. Where, however, the broken ends of the bone are maintained in close apposition throughout, no excessive callus formation occurs.

Treatment. When a bone has been broken, it is of the first importance to ensure that the injured parts are disturbed as little as possible until skilled assistance can be procured. If one of the bones of the limbs be broken, the limb above and below the injured spot should be rendered immovable by the application of a splint, before any attempt is made to disturb the patient. A temporary splint can be improvised by applying a walking-stick or other rigid body to the limb, and fixing it above and below with handkerchiefs. In the case of the leg, if such appliances are not to hand, the injured limb can be attached to the sound one. The surgeon's first proceeding in dealing with a fracture is to *reduce* or *set* it—that is to say, the injured fragments are placed by manipulation as nearly as possible in their natural position. For the satisfactory reduction of a fracture it is often considered advisable to administer an anæsthetic. When the fracture has been set, a *splint* is applied to the limb so as to maintain the parts immovable, and to keep them so while the process of healing goes on; a splint may be made of wood or gutta-percha; in some cases a plaster-of-Paris bandage is applied and allowed to set in an appropriate position. In some rare instances imperfect union of the broken ends occurs, and an ununited fracture results. There are certain serious complications of fractures—*e.g.* *œdema*, *gangrene*, and the septic troubles which are sometimes associated with a compound fracture.

Fra Diavolo (1769 (?)–1806), an Italian brigand, whose real name was MICHELE PREZZA. Born at

Itri, near Gaëta, he was successively stocking-weaver, soldier, and monk. When discredited for misconduct he retired to the mountains of Calabria, where he gained the name of "Friar Devil" for his cold-blooded robberies and murders. In 1798 he rescued Gaëta from the French, and in the following year assisted Cardinal Ruffo against them. For his services he not only received his pardon, but was also pensioned and given the rank of colonel in the Neapolitan army. Driven out of Gaëta and Calabria by the troops of Joseph Bonaparte in 1806, he concerted a rising with the English and

Bigods, Mowbrays, and Howards, Earls and Dukes of Norfolk, but now belongs to Pembroke College, Cambridge. From hence, on the death of Edward VI., Mary Tudor set out for London to gain possession of the crown. The flintwork church, recently restored, contains the tomb of Surrey, the poet. The Albert Memorial Middle Class College was built in 1865. Pop. (1901), 5,407.

Franc, a silver coin, weighing 5 grammes, and equivalent to about 9½d. The name was first adopted in France in 1799 as a substitute for the old *livre*.



MAP OF FRANCE.

the ex-queen. After visiting Capri and other islands he again landed in Calabria, but was betrayed to the French and executed at Naples.

Fragonard, JEAN HONORÉ (1732-1806), a French painter, was born at Grasse in Provence. After gaining the *grand prix de peinture* in 1752, he went to study at Rome. In 1765 his *Coreus and Callirrhoe* gained him election to the Paris Academy, and until the Revolution, when he was appointed a keeper of the Musée, he continued to paint excellent landscapes after Ruysdael and historical and *genre* pictures. The latter, many of which are in the La Caze collection in the Louvre, were highly popular on account of their voluptuous grace and fine colouring. In spite of his early success, the artist died poor. His son, ALEXANDRE ÉVARISTE (1780-1850), excelled in sculpture and historical painting.

Framlingham, a market town in Suffolk, 22 miles N.N.E. of Ipswich, with a population of 2,518. The castle was successively the seat of the

and was adopted as the unit of the monetary system in Belgium, Italy, and Switzerland in 1865. It is divided into 100 centimes or 20 sous (5 centimes). In Greece, where it was adopted in 1882, it is called *drachma*; in Spain (in 1871), *peseta*; and the same coin has other names in Roumania, Serbia, and Bulgaria. In Italy a *lira* is a franc.

France, a country on the western side of Europe, is situated between the 43rd and 51st degrees of north latitude, and from 8° 25' east longitude to 4° 45' west. The total area is reckoned as nearly 204,100 square miles. The boundaries are the English Channel on the N., the Atlantic on the W., the Pyrenean mountains and the Mediterranean Sea to the S., and on the E. the Alps, the Jura, and the Vosges mountains, leaving as the only unprotected frontier the north-eastern corner, bordering on Germany and Belgium, and this has accordingly been the battlefield of European nations.

The oldest rock which comes to the surface is the granite, which forms Cape Finisterre and great

part of the peninsula of Brittany. From thence follow in regular gradation east and south, limestone, chalk down to the tertiary, and wide spaces of post-tertiary and alluvial soil. On the south-east these meet the slopes and the various strata depending on the Alps. The Jura and the Vosges are thought to have been part of a separate island, and consist of parallel ranges, none of any great height, and consisting of the strata called after the Jura, limestone, chalk, etc. The Pyrenees are igneous towards their eastern extremity, afterwards of the limestone formation; and, though their height is not of the highest order, they afford few passes. Separated from them by a depression, called the Gap of Narbonne, is the wonderful wild volcanic group of Auvergne, extinct but showing astonishing traces of its origin. The hills, culminating in the Côte d'Or, run on to join the Vosges to the north-east, and to the north-west are called the Morvan.

These elevations divide France into numerous river-basins. The northern one from the Vosges contains the streams of the Seine, Upper Saône, Somme, and Marne. Starting from the Jura, the Loire, with its tributaries, runs westward to the Bay of Biscay. The Garonne flows north-west from the Pyrenees, and the Lower Saône and Rhone come down nearly due north and south through the valleys between the Alps and the Jura.

It will be easier to speak of the productions and condition of France in connection with the history than by separating the subjects. When first known to history this country was inhabited by Celts, and called Gallia, and was the centre whence swarms of plunderers poured over the mountains into Italy; but the Phœnicians and Greeks had a few trading cities on the Mediterranean coast—especially Marseilles—where in the seaport towns traces of descent from the Greeks are said still to be found. The Gauls were divided into tribes, whose names are still to be found in those of the towns. In 125 B.C. the Romans formed in the east of the Rhone a settlement ever since called Provincia or "the Province," whose capital was Aquæ Sextiæ (now Aix), and where corrupted Latin has never ceased to be the dialect, and their power and influence gradually spread. The first threatened Teutonic invasion was destroyed by Caius Marius (102 B.C.), and between 58 and 51 B.C. Julius Cæsar subdued the whole of Gaul, except the granite peninsula of the north-west. Later, refugees from Britain caused it to be called Brittany; and there to the present day the Celtic tongue has prevailed, and the habits have been peculiar. The Iberian or Basque tribes of the Pyrenees have likewise preserved their entirely different tongue, which is not even Aryan.

Roman habits, civilisation, and speech were adopted all over the country, and Christianity became nearly universal. Many cities were founded as centres of government from the conquered population, and most of the great cities such as Arles and Lyons and many others date from this time. Nîmes and Vienne show splendid monuments of Roman architecture. The Romans also made magnificent roads, and are said to have introduced the olive and the vine, to both of which

the climate is eminently suitable. Admirable, un-decaying roads traversed the country, but there was continual warfare on the open frontier with the advancing Teutonic nations, of whom the Belgians, a mixed race, were the van. The city of Lutetia Parisiorum, now known by its tribal name, Paris, was the headquarters of Emperor Julian before his accession in A.D. 361, while he was struggling with these invaders. After his death, Gaul became a prey to the Teutons. They did not destroy the old population, but quartered themselves as guests on the proprietors of land; while the Roman cities kept up their self-government, and paid ransoms to escape pillage. The Goths were Arian Christians before their conquest; the Burgundians divided between Arianism and the Catholic faith; the Franks still worshippers of Odin, Freya, and Thor, but they were awed by the superiority of the Roman Gallic priesthood, and in about 482 Clodowig or Clovis, the King of the Franks, embraced Christianity.

His family was known as the Merwings, or Merovingians, as they were Latinised, from his father, also as the Long-haired, because flowing locks were the token of chieftainship. Their domain extended far into Germany; but they only subdued, and did not settle, in the country to the south of the Loire. Though nominally Christians, they were savage, ferocious, and untameable, and they brought their old hereditary Teuton customs of inheritance and chieftainship, which, as they had last come from the banks of the Yssel, were known as Salic laws—i.e. of the Salian Franks. Their German dominions were called Austreich (the eastern kingdom); their Gaulish Neustreich (not Eastern) or Neustria; and both were Frankland. Their dynasty soon exhausted itself, and latterly their kings were called *Fainéants* or "Do-nothing" kings, while the mayors of the palace really governed.

One of these mayors, a Teuton wholly in blood, Charles Martel, in 721 checked the tide of Saracen invasion, and saved Gaul by the great battle of Soissons. His son, Pepin, in 753 was elected king, and thence descended the race known as Karlings. Charles the Great, called in French "Charlemagne," was one of the really great monarchs of the world. His dominions reached from the Ebro to the Channel, from the Elbe to the Atlantic, and included North Italy, and in 800 he was crowned by the Pope Emperor of the West. His power was too vast for a single hand of less power, and fell to pieces after his son's death. The Western Franks fell to Charles the Bald, and it was then (about 870) that France became a recognised term for the country between the Channel and the Pyrenees. The king had, however, very little power; his lands were cut up into divisions under dukes, marquises, and counts, who owned themselves his men in homage, and were bound to follow him in war, but ruled quite independently. Moreover, the Northmen or Danes were horribly ravaging the whole country; Paris was fortified against them under Robert the Strong, but in 911 King Charles the Simple found himself obliged to make to Rolf Ganger, the chief of the Northmen invaders, a grant of the Neustrian lands, which took the name of Normandy. The

Karlings finally were deposed in 987, and their representative retired to Lotharingia or Lorraine as duke. The grandson of Robert the Strong, Hugh, became king. He was called Capet, apparently from the hood which marked him as guardian of the Abbey of St. Denis; and the name is used for his dynasty, which reigned for eight hundred years. The German influences had passed away, though the king and nobility were of Frankish blood. The whole realm was parcelled out into feudal holdings, the great chiefs of which hardly owned the royal power, and the only place where the king really ruled directly was the county of Paris. There was much confusion and private warfare, and after the conquest of England in 1066, the Dukes of Normandy overshadowed the French kings. Louis IV. ("the Fat"), in 1108, was the first king of any ability. He judiciously overcame a robber count, and in his time (though not on any fixed principles) cities began to be allowed to purchase their power of self-government, such as the southern ones had preserved from Roman times. This was called the right of *commune*. Except in these cities, the lot of the people of Gallo-Roman blood was wretched. They were called villeins, and, except that they were attached to the soil, were almost slaves, cruelly oppressed and downtrodden by their irresponsible lords, mostly Franks, who covered the land with fortified castles. There was, however, much religious zeal, which found its outlet in the Crusades, first proclaimed at Clermont, in Auvergne, in 1095, and in the religious orders, whose beautiful monasteries and splendid cathedrals still exist.

France was at its weakest under Louis VII., when Henry II. of England, by inheritance Duke of Normandy and Count of Anjou, had married the heiress of the great Duchy of Aquitaine, and obtained the heiress of Brittany for his son. Philip II., called Augustus, spent his life in undermining the power of the English kings, and when King John murdered his nephew, Arthur of Brittany, Philip held a court of justice, cited him thither, and, on his non-appearance, adjudged him to have forfeited Normandy and Anjou, which easily were conquered, leaving only Aquitaine as the possession of John's mother, and these lands, being held direct of the crown, much added to the royal power.

A strange heresy sprang up in the south, of which Albi was the centre. Freethinking habits led to much evil, and the violence of the period led it to be supposed that a crusade against the offenders as unbelievers was lawful. The war lasted for nearly thirty years, and involved the Count of Toulouse, whose lands were devastated, vines and olives cut down, villages razed, and all reduced to such a desert that it is said never to have recovered entirely. The heiress of the count married a brother of the king, and being childless, her county was added to the royal fief.

The king, Louis IX., was the best and most blameless of French sovereigns. It was he who, in 1258, established the Parliament of Paris. In every Teuton nation the king was supposed to take counsel and do justice among the other nobles and

freemen; but to attend courts of law in a large territory was a great vexation to the nobles, who would not come, and yet resented decisions made in their absence. Louis arranged that though every immediate vassal of the Crown had a right to sit in it, yet in its working state it should only consist of men trained in the law, with just nobles enough to give it authority. In this Parliament the wills and edicts of the king, and the taxes he imposed, were registered, but it was never like the English Parliament, and could not originate. The provinces, likewise, had parliaments to serve as courts of law. Louis's devotion led him to attempt two unfortunate crusades, and he died in the second, in 1270.

His grandson, Philip IV. ("the Fair"), had a desperate quarrel with the Papacy, and by underhand means succeeded in forcing Pope Clement V. to act as his tool and reside in his dominions. The Popes fixed their residence at Avignon, in Provence, a province belonging to the Empire, and held at present by Philip's uncle, Charles, Count of Anjou, but near enough for French influence. Here the Papal court continued for seventy years. Philip V. was an evil, violent, and unscrupulous man, and the three sons who reigned in succession after him had not his force of character. Their sister, Isabel, had been the wife of Edward II., and the claim of her son, Edward III., to the succession caused the miserable Hundred Years' War. The French claimant, Philip VI., was son to a brother of Philip the Fair, and appealed to the old Frank or Salic law, which was said to exclude females. Wretchedness and spoliation prevailed all over France at intervals, worse almost for the peasants than warfare, since disbanded soldiers preyed on them ruthlessly. In the pitched battles the French were beaten, chiefly because the misery of their poor prevented them from having stalwart archers like the English; but they gained back the cities lost one by one, and the result was that, in spite of a succession of splendid victories, the English kings lost their ancient inheritance of Aquitaine, and retained only Calais, which had been taken by Edward III. in 1346. The sufferings of the peasantry had been dreadful. There had been one frightful rising of them in 1356 called the Jacquerie, because Jacques Bonhomme was the court name for the rustic; but they committed savage cruelties; the reprisals were shocking, and things were unaltered, except that in 1439 King Charles VII. succeeded in restraining the licence of the hired soldiery, and in forming the nucleus of a paid standing army. In 1378 the Pope returned to Rome, but as the Avignon Cardinals objected to the change, they elected anti-popes, and the schism was only healed at the Council of Constance in 1418.

Humbert, the Dauphin or Count of Viennois, a small territory around the city of Vienne, belonging to the Empire, had, in 1349, died without heirs, leaving his fief to the eldest son of the French king, and Dauphin was thenceforth the title of the heir-apparent. The kingdom was nearly all in the king's hands, but there were still formidable feudal states, especially the old dukedom of Brittany and the dukedom of Burgundy, to which marriage and inheritance had lately united almost all the

Flemish and Dutch territories on the perilous corner of France, and mostly belonging to the Empire.

The reign of Louis XI. was a struggle with these princes and with the nobility (1461-1481). He was a hard and deceitful man, but sagacious, and one of the few statesman kings France has possessed. He favoured the cities, and encouraged trade, while he put down the risings of the nobles with a crafty and cruel repression. The Duke of Burgundy fell in a struggle with the Swiss, and Louis gained his French fiefs; also, by will, he obtained Provence, though this country remained a fief of the Empire. His son, Charles VIII., married the heiress of Brittany in 1491, and thus the kingdom had nearly reached its present extent. The next half-century, however, was distracted by the pretensions of the French kings to the kingdom of Naples and the duchy of Milan. Three kings—Charles VIII., Louis XII., and Francis I.—led armies into Italy to meet at first with brilliant success, and then be left to waste away between the climate and the Italian intrigues. These schemes, too, clashed with those of the House of Austria. The head of that family, Charles V., Emperor by election, united the kingdoms of Spain, and their claims in Italy, to the Netherlands inheritances from the dukes of Burgundy, and there were thus incessant wars, and an enmity never appeased between France and Germany. This connection with Italy brought into France much art and cultivation, but often of a corrupt description, and the marriage of the son of Francis I. to Catherine dei Medici, a cousin of the reigning Pope, was one of the most fatal events in history through the evil influence she exercised.

The wars, the subjection of the Pope, the schism, and the Italian taste for pagan art and literature, had all conduced to great corruption and immorality alike in laity and clergy, and there was a terrible reaction when the Reformation spirit came in, in the reign of Francis I. The first French Bible was translated by Farel in 1525, but the character of the Reformation was fixed by Jean Chauvin, better known as Calvin, a native of Picardy, severely logical, and going to the farthest extremes of contradiction to the Papacy. Though banished from France, and spending his days at Geneva, his book of Institutes became the code of faith and morals of the Reformed in Holland, France, and Scotland. The iconoclasm of the reformers brought down vengeance on them; and, as Francis I. wished to stand well with the Pope, both he and his son, Henry II., sanctioned and even witnessed the burning of several victims. Henry's reign is noted for the recovery of Calais, in 1557, by the Duke of Guise, one of the Lorraine family, who thus acquired great influence. Henry's early death in 1559, while his children were all young, left his wife, Catherine, acting as regent, and trying to hold the balance between Guise at the head of the Catholic party and the numerous Reformed, or as they were called, for some uncertain reason, Huguenots, who demanded not only freedom of worship, but greater immunity from the oppressions of the crown. The reigns of her three sons, Francis II., Charles IX., and Henry III., were all one struggle between these

powers, and the contest is known as the War of Religion, lasting forty years. Bloodshed and violence, profanity and desolation, stained the whole country. There were numerous battles, and many murders—among them that of Guise—and the crisis was when, on St. Bartholomew's Eve, August 24, 1572, Charles IX. was goaded into authorising a general massacre of all the Huguenots within reach of the young Duke of Guise and his followers. Hosts perished in the cities north of the Loire, but in the south the numbers were too large for attack. None of the sons of Catherine left children, and when the last, Henry III., was assassinated in 1589, the crown passed to Henry of Bourbon, descended in the male line from Louis IX. He was also King of Navarre, which little Pyrenean domain was thus added to the crown. He had been bred a Huguenot, and, though he joined the Catholic Church, he desired to keep an even balance between the two parties, and in 1598, by what was called the Edict of Nantes, he gave the Huguenots equal privileges with the Catholics. Under Henry IV., a man of personal charm, wide views, and solemn speech, and his great minister, the Duke of Sully, France began to recover and to commence her career of greatness; ruins were restored, the rivers connected by canals, trade flourished, and especially in southern France the culture of silkworms and the weaving of silk were encouraged. The generation of turbulent nobles, who had grown up during the wars of religion, were kept in check with a strong hand, but the mistake of attaching them to the court by creating highly-pensioned offices for them led to evil results. Henry was murdered in 1610, but after a short period of misrule his son's (Louis XIII.) great minister, Cardinal de Richelieu, carried on his policy, not beneficently but ambitiously. His hand was heavy on all internal resistance, and he devoted his whole soul to confirm the power of the crown and the country, and extend her conquests, while literature and art flourished under his encouragement. Cardinal Mazarin, though Italian by birth, pursued the same aims through the minority of Louis XIV., but there was a sharp struggle under him, known as the Fronde (q.v.), when the Parliament, backed by the nobles, made a last struggle for the remnant of liberty; but, as the nobles only acted out of personal jealousy of Mazarin, they soon deserted, and all resistance was at an end. Louis XIV. was a man of great ascendancy of character, solely bent on personal glory and that of France. The earlier part of his long reign was brilliantly successful, and he nearly gained the object of French ambition—the frontier of the Rhine. Under his minister, Colbert, in spite of the heavy burthens imposed by the king's wars, his buildings, and the pensions of the nobles, who paid no taxes, the prosperity of the country advanced, and France was the most influential, as well as the most formidable, state in Europe, alike through power, literature, art, and general splendour. In 1685 Louis, a strong Catholic though often in collision with the Papal Power, repealed the Edict of Nantes, and by persecution drove into exile his most industrious subjects of the south, and crippled trade. The establishing his grandson on the throne

of Spain led to disastrous wars, and the victories of the English and Austrians were almost the ruin of France in his old age, and were only checked by the Peace of Utrecht in 1713, just before the end of his 71 years' reign in 1715, leaving the country exhausted and the people weighed down.

His great-grandson, Louis XV., exaggerated his personal faults without his redeeming qualities. The Court fell into a disgraceful state of immorality, the peasantry starved, and so jealous was the superintendence of the governors of provinces and their subordinates that no beneficent owner of estates could do anything for the peasantry without incurring suspicion, while even the few agriculturists who prospered by thrift, lived apparently in poverty lest they should bring on themselves the exaction of Government, or of their own seigneurs, for whom they were bound to give forced labour as well as to pay heavy dues. A spirit of strong reaction set in among the educated, not only against the Government, but the Church, which had only too much share in the oppressions and in the corruptions. Philosophy of the free-thinking kind and ideal classical liberty were in vogue, chiefly through the writings of Voltaire, Rousseau, and a number of others, called the Encyclopédistes. The pent-up misery of the country had become unbearable, and when Louis XVI. succeeded his grandfather in 1774, it was clear that there must be some relief. The king, a good but slow and undecided man, wished for it, but was feeble and helpless; and, indeed, things had come to such a state that only a man of giant power could have guided the course of the torrent. Space forbids giving the steps of the Revolution. It began with the first convoking of the States-General, the really popular assembly of representatives, which had not met since 1614, and then in vain. Thenceforward there was a succession of barriers thrown down; madness set in upon the long-oppressed people, who wreaked the vengeance of a thousand years. Frightful mobs rose upon all whom they connected with their past misery. Nobles and clergy fell; the king was dethroned, and in 1793 was executed. A Reign of Terror set in, during which Robespierre and other fanatics, who thought they must destroy in order to build up, sent to the beheading machine, the guillotine, thousands of victims, and hoped to have swept away even the Christian religion, together with all the old abuses of power. When they fell in 1794, less sanguinary counsels prevailed, and, after sundry attempts at forms of government, Napoleon Bonaparte, of Corsican birth, climbed to supreme power. His course had been through victories. There had been attempts to put down the Revolution and free the king on the part of the neighbouring nations; and these had been defeated by the French in the frenzy of their new emancipation, and thence they had gone on to further conquests of Switzerland, Holland, and Lombardy, through which Napoleon rose to be the idol of the nation, and in 1804 became Emperor of the French. Changes had been made throughout the country. The old provinces, which had vexatious separate jurisdictions, according to their original divisions, were broken up into departments, and

uniformly governed. The tenants became possessors of their lands, but the law of primogeniture was abolished. The weights and measures were henceforth decimal divisions of the weight and circumference of the earth, and there was even an attempt to call the months by new names and to substitute decades of ten days for the week. A new and well-constructed body of laws, called the Code Napoléon, was set forth, and has been in force ever since, though Napoleon's ambition overreached itself. He had been victorious over every European country except England, and in 1812 invaded Russia and reached Moscow, but was forced to turn back from Moscow, and his Grand Army was nearly destroyed in the frightful retreat through a severe winter. The conquered nations rose upon him, his success deserted him, and in 1814 the Allies entered Paris. He was dethroned, and sent to the Mediterranean isle of Elba. Escaping, he rallied his old forces, but only to be defeated at Waterloo, and to be sent to spend the five remaining years of his life at St. Helena in the Atlantic.

Louis XVIII., brother of the late king, was restored, and both he and Charles X., the next brother, tried to restore as much as possible the old principles, but the nation disliked and distrusted them. Charles X. was narrow and imprudent, and in 1830 he was expelled by a revolution, and his distant relation, Louis Philippe, Duke of Orleans, became King of the French, as a constitutional sovereign. There was fair prosperity, thriving commerce, and manufactures, the navy was improved, and the conquest of the African territory of Algiers was begun; but distrust began to grow, and the democratic spirit chafed against the monarchy, peerage, and all the privileges of property. Another revolution, in 1848, expelled Louis Philippe and his family. There was a period of alarm and uncertainty, the mob of Paris being disappointed at gaining only equality of right, not of wealth. The apprehension felt by all respectable people caused the nephew of Napoleon I., Louis Napoléon Bonaparte, to be gladly welcomed as President; but in 1851 he used violence and bloodshed to sweep away all opposition to his re-election. The troops were turned in on Paris, and slew whom they would, till all opposition was silenced by this *coup d'état*. Thus in 1852 he obtained the Empire, and reigned for seventeen years, keeping the nation under a tight hand, but providing constant excitement and amusement for the populace, and declaring his empire to be of peace. However, he joined with England in the Crimean War against Russia, and, for the price of the old Duchy of Savoy aided Victor Emanuel to drive the Austrians out of Italy. Jealousy of the Prussian power, and need of excitement for the nation, seem to have driven him into provoking a war with Germany, in which the French fancied they should obtain the coveted west bank of the Rhine for their frontier; but their army had deteriorated, and a succession of defeats ended in the captivity of the emperor. Paris rose, and declared him deposed, enduring in the winter of 1870 a most distressing siege by the Germans, and after the surrender, the populace, in a frenzied state, rose again, calling themselves the Commune,

and endured another terrible siege by the army under the friends of order. When no longer able to hold out, the Communards did their best to burn the city, and destroyed many of the fine old historical buildings. They suffered for their crimes under execution and banishment to New Caledonia, and the memory of those days is miserable.

Adolphe Thiers, the veteran statesman, restored order, and since then France has had a republican constitution, with a seven-years' president, a ministry for the departments of Government, a Legislature of two Chambers (the Senate, with 300 members, and the Chamber of Deputies, with 584), and universal suffrage. All this time actual home administration has been practically carried on under the Code Napoléon, which has created an immense number of offices, all dependent on the Government at Paris, so that the centre absolutely commands everyone, from the mayor of a city to that of a parish, together with the dispensers of justice, and even keepers of tobacco shops; and thus all France is powerless to resist changes at the central seat of government. The bishops and clergy are likewise paid and appointed by Government, and at its mercy.

The army is recruited by conscription, to which all classes alike are subjected, every able-bodied male being obliged to serve for a certain number of years. Since the war of 1870-71 immense pains have been taken to raise it to the highest state of efficiency. It now numbers about 730,000 men. The navy, which attains a high standard of efficiency, consists of 400 vessels.

Ethnology. The present inhabitants of France are the outcome of numerous successive waves of migration and secular interminglings, which go back to neolithic times (men of the Polished Stone Age, contemporaries of the cave bear, mammoth, and reindeer), and, according to some authorities, even to the Tertiary epoch (men of the Palæolithic or Chipped Stone Age, contemporaries of the giant mastodon and *elephas antiquus*). But from a general consideration of the constituent elements of the population these rude cave-dwellers may be set aside as too few or too feeble to have appreciably affected subsequent generations. Nor need much account be taken of the few Phœnician and Greek colonists who had founded settlements on the shores of the Mediterranean some centuries before the new era, but who were nowhere numerous enough to leave any permanent trace of their presence on the surrounding populations. But before their arrival the land had already been long occupied by the direct successors, if not the descendants, of neolithic man—races associated with the introduction of bronze and later of iron, builders of pile dwellings in the lacustrine eastern regions, builders of dolmens, menhirs, and other monolithic monuments in the western districts (Brittany, Poitou, etc.). These lake-dwellers and dolmen-builders are, beyond doubt, largely represented in the present populations of France, though the attempts to identify them with any of the earliest Gaulish peoples known to history have led to no certain results. Such historic peoples are the *Ligurians* in the south-east, forming the transition to the primitive inhabitants of Italy; the

Aquitani in the south-west as far north as the Garonne, akin to the Iberians of Spain, and surviving in the Basques of the Pyrenees [*Basques*]; the Celts, or Gauls, of the central region between the Garonne and Seine valleys, a branch of the Kymric division of the Celtic family [*Celts*] surviving in comparative purity, especially in Brittany, Auvergne, and Savoy; lastly, the *Belgæ*, from the Seine to the Rhine delta, whose affinities have been much discussed, though Cæsar (*De Bell.* ii. 4), states distinctly that most of them (*plerouque*) were German intruders who had crossed the Rhine in remote times (*antiquitus*), and driven out the Gauls. The term Gaul itself has been variously interpreted, though the same authority tells us that it was synonymous with Celt (i. 1). Thus the substratum of the French population is clearly shown to consist of four distinct elements, two of Aryan speech (Celts and Germans), two of non-Aryan speech (Ligurians and Iberians). Of these the Celts, or peoples of Celtic speech, were by far the most numerous, and had probably absorbed most of the others about the new era when they began themselves to be rapidly assimilated in speech and usages to their Roman masters. Numerous Italian or Latin-speaking colonies had been already founded in the *Provincia Romana* (Gallia Ulterior), long before Cæsar's conquest of the whole country, and after that event streams of migration continued to flow over the Alps until, towards the close of the Empire, the people might fairly be described as "Gallo-Romans." Then came the irruption of the northern barbarians, nearly all Teutons: Franks in the north, Burgundians in the east, and Visigoths (West Goths), who penetrated to the south-west (Aquitania). But although the Franks established two powerful empires (the Merovingian and Carolingian), and also left their name to the land, none of these Germanic invaders exercised more than a local influence on the race, and all ultimately disappeared amid the Gallo-Roman populations. The same remark applies to the "Saracens" (Mohammedan Berbers and Arabs), who in the 8th century had reached as far as, and even beyond, the Loire, and in a less degree to the Normans, who had established themselves early in the 10th century (912) in the Seine valley, and who have certainly left their impress on the north-western populations. Since the 10th century France, with trifling exceptions (English in Guyenne, Flemings, Germans, Spaniards on the frontiers), has been free from the encroachments of foreign races, and the slow process of fusion in a single nationality, not yet completed, has thus been in progress for about 1,000 years. From the predominance of Teutonic elements in the north (Belgæ, Franks, Normans), and of Italic elements in the south (early and later Italian settlers in the *Provincia*) there resulted in mediæval times two great ethnical and linguistic divisions which shared the land between them in nearly equal proportions, and which still persist—*Celto-Teutons*, of *Langue d'oïl* speech, in the north; *Celto-Romans*, of *Langue d'oc* speech, in the south. But since the political union effected by Louis XI. with Paris, the great centralising

capital in the north, the northern has steadily tended to encroach on the southern division, so that the time is approaching when an ethnical union of *Langue d'oïl* speech (standard French) will also be effected. But pending this union, and pending the absorption of such tenacious, isolated groups as the Bretons, Auvergnats, Savoyards, and Basques, though there is a common nationality, we can scarcely yet speak of a common French type. Tall stature, dolichocephalic skulls, fair or light-brown complexions, grey or blue eyes, still prevail, as might be expected, in the north, for these traits are characteristic of Belge, Franks, and Norsemen alike; to them correspond short stature, olive-brown complexion, brachycephalic skulls, dark brown or black eyes in the south, and notably in the Cevennes and other hilly districts, where possibly a primeval non-Aryan element still survives. The tendency towards uniformity has proceeded at a much more rapid rate in the large towns than in the rural districts. Hence large urban populations, such as those of Marseilles, Lyons, Bordeaux and Paris, present far less striking contrasts than do the inhabitants of the old historical provinces, where may still be distinguished the loquacious and mendacious Gascon, the pliant and versatile Basque, the slow and wary Norman, the dreamy and fanatical Breton, the quick and enterprising Burgundian, the bright, intelligent, more even-tempered native of Touraine—a typical Frenchman, if there be any—occupying the heart of the land and holding, as it were, the balance between all the surrounding elements. Taken as a whole, the modern Frenchman stands somewhat intermediate between the southern and northern peoples, less steadfast than the Teuton, more energetic than the Italian, less personally independent than the Anglo-Saxon, hence betraying a lack of individual enterprise, most great movements being initiated by their rulers, whereas the opposite is the case in England—no French names to place by the side of the Hampdens, Peuns, Howards, Wilberforces, Cobdens, and other marked personalities, leaders of great national, philanthropic, or colonial undertakings; no great French trading corporations comparable to the historical East India, Hudson Bay, and other more recently-chartered companies. The moral sentiment is also certainly defective, so also the love of show and glory is stronger than the sense of duty. On the other hand, the artistic sense is highly developed, while the purely intellectual qualities are far above the average, as reflected in the scientific and literary work of the nation, and in the cultivated language which within certain limits is almost an ideally perfect instrument of human thought. The Frenchman, and especially the Frenchwoman, excels also in conversational powers, and in all matters pertaining to taste, etiquette, tact and the social amenities, where brilliancy and vivacity find freer scope than the more solid qualities of the reasoning faculty. With more outward polish, French culture penetrates less deeply through the social strata than does the refinement of the cultured classes in England. At the same time, the substantial qualities of patience, economy, and love of labour cannot

be denied to the French peasantry, who thus act as a counterpoise to the extravagance and frivolity of urban life. By hoarding their small savings, and by domestic thrift verging on the sordid, they have made France one of the richest countries in the world, better able than most others to survive tremendous catastrophes, and rise buoyantly from apparently overwhelming disasters. Thanks to these qualities, combined with a pronounced military spirit and love of conquest, the French people have played a leading part in the world's history since remote times, and have become an almost necessary element in the general progress of human culture. The population in 1906 was 39,252,267. [FRENCH LITERATURE.]

Francesca, PIETRO DELLA, an Italian painter, often known as PIERO BORGHESE, from the name of his native town, Borgo San Sepolchro, in Umbria. He was born probably about the year 1415, and died either in 1492 or 1494. He assisted Domenico Veneziano with the frescoes of Sant' Egidio, Florence, and probably also was engaged with him at Loretto. About 1451 he finished for the Duke of Rimini the series illustrating *The Legend of the Holy Cross* at Arezzo. At Urbino, where he made the acquaintance of Raphael's father, he painted for the Duke, *The Flagellation*. The National Gallery, London, contains three of his pictures, besides a portrait attributed to him. He was one of the earliest painters in oil, and left a treatise on perspective, copies of which are at Milan and in the Vatican Library. Among his pupils were Luca Signorelli, and perhaps Perugino.

Francia, IL (1450-1517), is the name by which the Bolognese painter, FRANCESCO RAIBOLINI, is commonly known. He was the son of a carpenter, and worked for some time as a goldsmith. His earliest work in painting resembles that of the Ferrarese school, but his later manner, of which there are some fine examples in the National Gallery, London, was founded on a study of Raphael, whom he may have known personally. Francia held the office of Master of the Mint at Bologna, where he was "reverenced as a god." Two of his sons were painters, and the works of Giacomo, who died in 1557, have often been attributed to him.

Francia, JOSÉ GASPAR RODRIGUEZ DA (1757-1840), the celebrated dictator of Paraguay, was born at Asunción. Although he took the degree of doctor of theology, he soon became a lawyer, and had filled several official positions in his native town when the royal government of Paraguay was overthrown in 1811. As secretary to the revolutionary Junta, he made such good use of his position that when, after two years, a republic was established under the direction of two consuls, he became one of them. Having gained popularity by depriving the Spaniards of civil rights, he was named at first sole dictator for three years, and in 1817 secured supreme power for life. With the help of a secretary, he controlled the government in its minutest details, and by a system of espionage put down the slightest opposition to his person. Military executions were frequent, and heavy fines were the only alternative. Exportation was

forbidden and internal trade strictly regulated, while the dictator himself was an active cattle-dealer. His leisure hours were given to study, astronomy and French philosophy being his favourite reading. Like Louis XI., his chief counsellor was a barber, but Napoleon was the great object of his admiration, and he imitated him even in his dress. In spite of its harshness, Francis's government was popular, and he at all events saved Paraguay from the anarchy which prevailed in the surrounding states.

Francis, SIR PHILIP (1740-1818), was the determined enemy of Warren Hastings (q.v.), and has been maintained by Macaulay and others to have been the mysterious "Junius." He was born at Dublin, and was at St. Paul's school with Woodfall, editor of the *Public Advertiser*, in which the famous *Letters* appeared. At sixteen he entered the Civil Service, acted for a short time as amanuensis to the elder Pitt, and from 1762 to 1771 was a clerk in the War Office. Two years later he went to India as member of the Council for Bengal, where he steadily and acrimoniously opposed Hastings, by whom, in 1780, he was wounded in a duel. After his return to England he entered Parliament, took an active part in the impeachment of the late Governor-General, and identified himself with the advanced Whigs. He wrote many pamphlets somewhat in the style of "Junius," but never claimed the authorship of the *Letters*. [JUNIUS, LETTERS OF.]

Francis I. (1494-1547). This King of France was the son of Charles, Comte d'Angoulême, and Louise of Savoy, and succeeded his uncle, Louis XII., whose daughter he married, in 1515. He immediately set about the reconquest from Maximilian Sforza of the Milanese duchy, which he claimed through his mother. The Swiss mercenaries were defeated at Marignano, and Francis proceeded to Rome, where he concluded a concordat with Leo X. Having been an unsuccessful candidate for the Empire, he sought the aid of Henry VIII. against his rival, and the meeting at Ardres, called the "Field of the Cloth of Gold," took place in 1520. In the first war between Francis and Charles V., however, England took sides with the latter, and the French king, attacked on all sides, was defeated and made prisoner at Pavia in 1525. After renouncing his Italian possessions and the suzerainty over Flanders and Burgundy, Francis was released, but immediately recommenced the war. The Pope was taken prisoner and Rome sacked, but by the Treaty of Cambrai (1529) France got little better terms than before. Five years later, the "Most Christian King" renewed the war, with Solymán the Magnificent, Sultan of the Turks, as his ally. The treaty concluded at Nice for ten years lasted only four, and in his last war, though England was the ally of the Emperor, Francis was less unfortunate than he had been before. Charles V., defeated at Cerissoles, deserted his ally, and made the separate peace of Crépy (1544), but war with England continued two years longer, Boulogne remaining in the hands of the latter at its close. Francis was indifferent in religious matters; he persecuted

the Protestants in the Vaudois, but supported them in Germany. Though a typical Frenchman with his love of military glory and of gallantry, the Italian element in his character appeared alike in the shiftness of his diplomacy and in his magnificent patronage of literature and art. He founded the Royal College of Paris and collected a fine library at Fontainebleau, beside building several palaces, and filling them with the treasures of art. His portrait painted by Titian is in the Louvre.

Francis II. [MARY STEWART.]

Francis I. (1708-65), Emperor of Germany [MARIA THERESA.]

Francis II. (1768-1835), last Roman Emperor and first Emperor of Austria (Francis I.), was the son of Leopold II., whom he succeeded in 1792. His first act was to abandon his father's pacific policy by joining Frederick William II. of Prussia in a war against the French Revolution. The result was that by the Treaty of Campo Formio (1797) Austria gave up the Netherlands and Lombardy, but obtained in exchange the territory of Venice, with Dalmatia and Istria. After a short interval the war was renewed, with subsidies from England and troops from Russia, but Francis, defeated at Hohenlinden and Marengo, had to sign the Peace of Lunéville in 1801. A third attack on France ended in the disaster of Austerlitz (1805), after which Francis, finding even his nominal power in Northern Germany destroyed by Napoleon's organisation of the Confederation of the Rhine, voluntarily abandoned the title of "Roman Emperor Elect" (August 16th, 1806), ending thereby a succession which in theory had been unbroken since Cæsar, and abandoning a title borne by the Hapsburgs with few intermissions since the thirteenth century. He had already, in 1804, proclaimed himself Emperor of Austria. The crowning humiliation of the reign was reached in 1809, when, after Wagram, Francis had to give his daughter, Maria Louisa, in marriage to the usurper Bonaparte, besides ceding large portions of his dominions. From this time the Emperor entrusted the direction of affairs to Metternich, through whose policy he was able to throw off the alliance with Napoleon, and to more than recover his territorial losses.

Francis Joseph, CHARLES, Emperor of Austria and King of Hungary, was born in 1830, and, on the abdication of his uncle, Ferdinand I., in 1848, succeeded him. He took the field in person against the Hungarians, and, with aid from Russia, suspended their constitution and undid the work of the revolutionists. He was present at the battle of Solferino (1859), after which France and Italy compelled Austria to give up Lombardy. In 1864 Austria helped Prussia to deprive the Danes of Schleswig-Holstein, but two years later the allies quarrelled, and the headship of Germany passed from the former to the latter, who also lost Venice. In 1867 the Hungarian question was settled by the establishment of the dual monarchy and his coronation as King of Hungary, the personal popularity of Francis Joseph forming a strong unifying element. The aim of his subsequent policy has been the preservation of peace by the

conciliation of Germany and Italy and the formation with them of a Triple Alliance. Russia has been the main cause of anxiety, and, by the Treaty of Berlin, Austria was allowed by the Powers to occupy Bosnia as a counterpoise to Russian influence in the Danubian States. Francis Joseph's only son, the Crown Prince Rudolf, committed suicide in February, 1889, and the Archduke Francis Ferdinand then became heir-presumptive. In 1910 the eightieth birthday of Francis Joseph was celebrated with universal rejoicings.

Francis Xavier. [XAVIER.]

Francis of Assisi (1182-1226), founder of the Franciscan Order, was born at Assisi of a family named Bernardone. His Christian name was really John, but he was called Il Francesco or "The Little Frenchman," from his knowledge of the Provençal language. Like Loyola, he had been a soldier before he became a saint; it was during a year's captivity at Perugia that he first turned his thoughts to a religious life. He exchanged clothes with a beggar, spent a month in a cave, praying, and finally abandoned all his possessions. Having left his father's house, he begged at the gates of monasteries, tended the lepers at Gubbio, and assisted with his own hands in the building of two churches. After some years he was joined by two fellow-townsmen, and in 1210, when there were eleven brothers, he drew up for them his threefold rule, consisting of vows of poverty, chastity, and obedience. Two years later, having received informally the Papal sanction, the seat of the Order was fixed at Santa Maria degli Angeli of Assisi. The number of brethren rapidly increased, there being in 1219 as many as 5,000. St. Francis himself, in 1223, preached before the Sultan of Egypt, and obtained for his Order the guardianship of the church of the Holy Sepulchre. After his return to Italy he is said, while praying on Monte Alverno, to have received upon his person the marks of the wounds of the Redeemer. Narrators of the legend place this occurrence in the year 1224. On October 4, 1226, St. Francis died; two years afterwards he was canonised by Gregory IX. He left behind him works, both in prose and verse, characterised by a tender simplicity and great love of nature. He is one of the most cherished saints of the Roman Catholic Church. [FRANCISCANS.]

Francis of Sales (1567-1622), the author of the *Introduction to a Devout Life*, was born at the castle of Sale, near Annecy, in Savoy. He entered the Jesuits' school at Paris in 1578, and afterwards studied civil law at Padua for seven years. Refusing a brilliant marriage, he took orders, and soon became a good preacher. After the great success of his mission (in which persuasion was liberally backed by stronger measures) among the Calvinists of Chablais, he was induced to accept the position of coadjutor to the Bishop of Geneva, on whose death he succeeded to his see. He declined several offers of French bishoprics and also a cardinalate, and laboured in his own diocese to the last. He died three days after Christmas in 1622, and was

canonised by Alexander VII. in 1665, January 29 being appointed as his festival. His great work has been translated into numerous languages, and has always remained popular. Lives of him by Hamon, Perennes, and Mrs. Lear have been issued within recent years.

Franciscans, THE, a religious order founded in 1208 by Francis of Assisi (q.v.), and finally established by Pope Honorius III. in 1223. It rapidly grew in numbers, there being in fifty years nearly 200,000 monks and over 7,000 convents. At present there are about 100,000 Franciscans, who are governed by a general at Rome, "provincials" or heads of provinces, and heads of convents, who are called *custodes*. All these officers are elective. Novices are called "scholars;" priests are known as "fathers;" and the rest are "brothers." Besides the regular monks, there are members of the Franciscan Institute, who are called Tertiaries (members of the Third Order). These are not bound by the letter of the vows. They need not be celibate, and may hold property, but they must restore ill-gotten goods, and must not be extravagant or luxurious, and are bound to hear mass daily, to be reconciled to their enemies, and to devote some of their time to the sick and the ignorant. The vow of poverty has been something of a stumbling-block in the history of the Franciscans. One party observed the traditions of St. Francis in the letter, and, under the name of "Observantists," obtained a separate organisation from Leo X. The "Conventuals" or unorthodox section allow ornaments in their churches, and are permitted to hold property in the name of the Order. The Capuchins, another branch of the stricter section, deriving their name from their *capuche* or hood, were formed at the time of the Reformation, and increased rapidly after the Council of Trent. The "Barefooted Franciscans" sprang up in Spain under Peter of Alcantara, and obtained a new rule in 1555. There are also several orders of Franciscan nuns, one of which, the Clarissines, was founded by St. Clara, sister of Francis, in 1212, and is the second Order of St. Francis. As missionaries, the Franciscans have been very active from the first; they have convents all over the world. As theologians, they upheld free-will against the Dominicans, and in metaphysics they were Realists. Among their great names are St. Bonaventure, Cardinal Ximenes, Duns Scotus, and Roger Bacon. Lope de Vega was a tertiary. Sixtus V., Clement XIV., and other Popes belonged to the Order, as likewise did the authors of the *Dies Ire* and *Stabat Mater*. In England the Franciscans, known as Grey Friars, were very active in the reign of Henry III., and founded monasteries at Canterbury and Northampton. At the dissolution of the monasteries they had 65 houses; there are now five, and fourteen in Ireland, besides Capuchin convents in both. Luke Wadding, an Irish monk, was the historian of the Order of St. Francis, and his work has been largely supplemented since his death (1657). The Grey Friars are sometimes called Minorites and Seraphic Brethren.

Franck, SEBASTIAN (1499-1542), one of the earliest German writers, was born at Donauwörth. He was early converted to Protestantism, but was in 1531 compelled to leave Strasburg, because he had advocated religious toleration, which was then in favour with no party. He afterwards became a soapboiler at Esslingen, and a printer at Ulm. Having been expelled from the latter on account of his *Paradoxa*, he went to Basel, where he died. Franck was the author of a *Treatise Against the Horrible Vice of Drunkenness* (1528), *Chronica des Ganzen Deutschen Lands* (1538), and other works; and he printed a collection of popular proverbs in German in 1541.

Francke, AUGUST HERMANN (1663-1727), a German educational philanthropist, was born at Lübeck. He was Professor of Oriental Languages at Halle from 1692 to 1698, when he took the chair of theology. He founded there several schools and a seminary for training teachers, besides an orphanage. Poor children were given a religious education, and were also instructed in German, natural science, and technical knowledge, physical exercises being attended to besides. All these foundations are still in existence, and others in the shape of a gymnasium, two schools for girls, and a free school have been added. Francke was the pupil of Spener, and the teacher of Zinzendorf.

Francolin, any bird of the genus *Francolinus*, with 34 species, from Africa and the south of Europe, ranging eastwards to India and China. These birds are closely allied to the partridge (q.v.), and seem to connect that genus with the brilliantly plumaged pheasants and tragopans.

Franconia is the name now given to a district comprising three circles in the north of Bavaria. The adjacent countries received in 1806 part of the old circle of the Empire, which lay between Upper Saxony, the Rhine, Bavaria, and Bohemia. As the "Land of the Franks," it was looked upon as the centre of the Holy Roman (or old German) Empire, and was till 1501, when the circles were formed, composed of Eastern and Rhenish Franconia, the latter half ceasing henceforth to form part of the territory known by that name.

Franco-Tireurs ("free-shooters"), a name given to irregular infantry (originally bands of peasants) during the Franco-German War. They were at first not recognised by the Germans as belligerents, and, when captured, were shot; but were afterwards formed into a regular corps, and as such obtained a military standing.

Frangipani, an old Roman family, whose name is supposed to have been derived from the fact that one of them distributed bread (*frangere panem*) to the poor of Rome. Cencio Frangipani deposed Pope Gelasius II. and set up Gregory XIII. as Anti-Pope, and Giovanni, Lord of Astura, captured Conradin of Suabia in 1268. A branch of the old Ghibelline house still survives in the province of Udine.

Frankenstein, the title of a work by Shelley's second wife, the daughter of William Godwin. The name of the man who, in the story, creates by his knowledge of science a monster which haunts him.

The word has come to be used proverbially of a creation disastrous to its author.

Frankfort-on-the-Main, a city in the province of Hesse-Nassau on the right bank of the Main, and 112 miles S.E. of Cologne. From 1257 till the breaking-up of the old German Empire in 1806 it was a free city, and again from 1816 till 1866, when it was punished by a heavy fine for supporting Austria in the war, and made a Prussian city. The treaty which closed the Franco-German War was signed here on May 10th, 1871. The chief buildings of Frankfort are the Roemer, or town-house, built between 1405 and 1416, which contains the Kaiser saal, where the Emperors dined in state and where portraits of them from Conrad to Leopold II. hang; the cathedral, where they were elected and crowned; and the palace of the Prince of Thurn and Taxis, in which the North German Diet sat. As a commercial centre, the town is of great importance, and is the junction for seven railways, the central station being one of the finest in Europe. It was formerly celebrated for its fairs, but it is now chiefly important as a money-market, the firm of Rothschild being among its bankers. A new exchange was opened in 1879. Among its institutions are two conservatories of music and a public library. The suburb of Sachsenhausen, on the left bank of the Main, is connected with the city by seven bridges. By means of the rivers Main and Rhine there is direct water communication with the North Sea. Goethe, the greatest of Germans, was a native of Frankfort, and has a statue in one of its squares; and there is also a monument commemorative of the inventor of printing, Gutenberg.

Frankfort-on-the-Oder, a town in the province of Brandenburg, Prussia, 51 miles E.S.E. of Berlin. It was one of the Hanse towns in the 14th and 15th centuries, and is still of commercial importance. Among its manufactures are machines, organs, chemicals, and paper; it has also tanneries and breweries; and three fairs are held in it every year. The town is situated on the Oder, and is connected by canals with the Elbe and Vistula. The university was founded in 1506, and in 1811 was incorporated with that of Breslau.

Frankincense, or *OLIBANUM* (*oleum Libani*), the gum-resin of several species of *Boswellia*, trees belonging to the order Burseraceæ. They have deciduous, scattered, imparipinnate leaves, and clusters of pentamerous flowers. *B. Frereana*, the "Yegaar," *B. Bhau-Dajwana*, the "Mohr Add," and *B. Carterii*, the "Mohr Meadow" of Somali-land, and a variety of the last-mentioned, known as "Maghrayt d'Sheehaz," in Hadramaut, on the opposite Arabian coast, are the sources of true frankincense. The first-named is inferior. Frankincense is exported from Somali-land to Bombay, and thence to Europe, some 7,000 to 8,000 packages coming to London annually. It is in semi-opaque tears or lumps, yellowish or almost colourless, covered externally with white dust, bitterly aromatic in taste, and having a slight smell before being heated. It contains a gum, soluble in water, closely allied to gum-arabic, 72 per cent. of resin, soluble in

alcohol, a colourless essential oil containing *oliben* ($C_{10}H_{16}$), and an ash consisting mainly of carbonate of lime. It burns with a bright white flame, and is used in Arabia as an illuminant and for chewing. It has a stimulant action on the mucous membranes, is cheaper than balsam of Peru, and is useful as a fumigant in bronchitis; but it is mainly used as incense (q.v.). The name of common or European frankincense is applied to the resin of the Norway spruce (q.v.), *Pinus excelsa*, and of *Pinus Tada*; and in the United States that of *Pinus australis* is so called.

Franking was the privilege of sending and receiving letters without payment to Government. The origin of the practice probably was that the Post Office at first only transmitted official correspondence. Anyone, therefore, who occupied an official position, claimed in after days to share the benefit of it. Thus, in England in 1660 the Commons claimed it in granting the postal revenue. The privilege was not, however, expressly granted till 1764, when it was declared by statute that every member of either House was entitled to send out free 10 letters, of not more than an ounce in weight, every day, and to receive 15. The privilege was so much abused that in 1837 it had to be guarded by provisions that the member must write his whole address on the letter, which must also bear his name, the name of the post-town, and the date when it was posted; and that this last must be either the day on which it was written, or the next; moreover, the post-town must be within 20 miles of the franker's residence. With the introduction of the Penny Post in 1840 the privilege came to an end. In the United States franking was even more abused, and was not abolished till 1873.

Franklin, the freeholder who held his lands direct from the Crown. He seems to have held a good position in the time of Chaucer, among whose pilgrims in the prologue to the *Canterbury Tales* he appears. In later times his position appears to have been that of the superior yeoman.

Franklin, BENJAMIN, the great American natural philosopher and diplomatist (1706-1790), was born at Boston, Massachusetts, the youngest son of a large family. He was taken from school at the age of twelve to learn printing with his brother, James; and when the latter was imprisoned for libel, carried on his journal for him. Longing for independence, Benjamin, at the end of five years, left Boston, and sailed to New York; but ultimately went to Philadelphia, where he was employed by a printer. To gain further experience, he was persuaded to go to England in 1724, and was eighteen months in a London house. On his return he set up a printing business for himself, and a few years later began to conduct a newspaper. In 1732 he began to publish *Poor Richard's Almanac*, and five years later was made postmaster of Philadelphia. Soon after this he was elected to the Pennsylvania Assembly, and became Deputy Postmaster-General for the colonies. In 1746 began the period of scientific research. He proved experimentally the identity of electricity with lightning,

suggested lightning-conductors as a protection for buildings, and made other discoveries in physics, which gained him election to the Royal Society of London. He also laid the foundations of meteorology by his description of the course of storms over North America; pointed out the use which could be made of the thermometer in navigation; and in optics showed in what manner different colours absorbed solar heat. In 1757 he went to England as agent for Pennsylvania, and was there for five years. In 1764 he came over to represent the opposition of the colonies to the Stamp Act, and after a fruitless mission returned to America in 1775. He was immediately elected a delegate to Congress, and took an active part in its deliberations. He was now sent to Paris in order to obtain the help of France for the resisting colonists, and in 1778 saw his efforts crowned with success. He did not return to America till 1785, some two years after he had signed the treaty by which the independence of the United States was recognised. After having been thrice President of his own State and a delegate to the Constitutional Convention of the United Colonies, he retired from public life in 1788. Franklin's autobiography and writings have been edited by John Bigelow, who has also written a life of him. W. T. Franklin, his grandson, Jared Sparks, and James Parton are also among his biographers.

Franklin, SIR JOHN, naval officer and Arctic explorer, was born in 1786 at Spilsby, Lincolnshire, entered the navy in 1800, served in the *Polyphemus*, 64, at Copenhagen, and accompanied Flinders in the *Investigator* to Australia. Returning home in the *Earl Camden*, he was present at Dance's famous action, and in 1805 he fought in the *Hellerophon* at Trafalgar. He was made a lieutenant in 1808, and served during the rest of the war in the Low Countries and America. His first voyage of discovery was made in 1818, when, in command of the *Trent*, he accompanied Buchan's expedition towards Spitzbergen. In 1819 he was given command of a perilous overland expedition from Hudson's Bay towards the mouth of the Coppermine river, and travelled 5,550 miles, not returning to England until 1822. In his absence he had been made commander in 1821, and upon getting home he was made captain. He published an account of his adventures in a *Narrative of a Journey to the Shores of the Polar Sea*. In 1825 he was despatched to co-operate with Beechey and Parry in the search for a north-west passage. This voyage provided material for his *Narrative of a Second Expedition to the Shores of the Polar Sea*. On his return he received many honours and rewards, and was in 1829 knighted. From 1830 to 1834 he commanded the *Rainbow*, 28, in the Mediterranean, and he was subsequently Lieutenant-Governor of Van Diemen's Land. In 1845 he was despatched in the *Erabus*, with the *Terror* in company, on a renewed search for the north-west passage through Lancaster Sound and Behring Strait. After July of that year the expedition disappeared from civilised ken. In three years England became very anxious concerning it, and thenceforward for

many years search expeditions, both public and private, were sent out. These expeditions discovered many interesting facts, but learnt little of the fate of Franklin, until in 1857-60 Captain (afterwards Sir) Leopold M'Clintock, in the yacht *Fox*, ascertained conclusively that Franklin had died, that the vessels had afterwards been abandoned in ice near King William Sound, and that all the officers and crew had perished in their endeavours to reach the Great Fish river. Franklin's death occurred on June 11, 1847; but, owing to the doubts and hopes concerning him, his name was not removed from the Navy List until after 1852, when it appeared as that of a rear-admiral. Sir John had married in 1823 Miss Eleanor Anne Porden, and, a second time, in 1828 Miss Jane Griffin. The latter lady, a most devoted wife, spared neither expense nor exertions to discover tidings of her distinguished husband; and the *Fox*, which finally cleared up the sad mystery, was but one of several vessels that went out at her cost. Lady Franklin died in 1875 at the age of 75. It should be added that the later researches of Hall (1871-73) and Schwatka (1880) have borne out the information which was obtained by M'Clintock, and that these, as well as other travellers, have succeeded in securing many pathetic relics of the lost expedition.

Frank Pledge, called also FRITHBORH and TENMANNETALE (in the north), an association of 10 men, under the headship of a Capital Pledge, who were to be securities for each other to the law. If unable to produce any one of their number when duly called upon, they were liable to make good any injury he had done, provided they were unable to disprove their complicity. The principle was probably to substitute an artificial tie for the natural one of the family, which had become loosened. Frank-pledge is first described in the so-called laws of Edward the Confessor; but it grew up naturally from the law of Æthelstan, re-enacted by Edgar and Knut, that every man should have a security for him.

Franks. [FRANCE.]

Frans, ROBERT (1815-1892), a German musical composer, was born at Halle, in which town, while his health lasted, he held various appointments. Having studied under Schneider at Dessau, he published in 1843 twelve songs, which won the approbation of Mendelssohn, Schumann, and other masters. He produced altogether 250 songs, many of them of a high degree of merit, besides a *Kyrie* and arrangements of Handel and Bach. In 1872 a series of concerts were arranged for his benefit under the patronage of Liszt and Joachim, and were highly successful. He died in October, 1892.

Franz-Josef Land, an Arctic archipelago between lat. 80° and 83° N., discovered and partly explored by Payer and Weyprecht in 1873-74. Welczekland on the E. and Zichyland on the W. are divided from one another by Austria Sound. Flat-topped basalt mountains, usually sheathed with ice, and rising to 5,000 feet, cover the surface of the archipelago. Animal life is abundant, and in

summer the coasts are open. Franz-Josef Land was further explored in 1880-82, and has been looked upon as a good base from which the North Pole may be reached.

Franz, KARL EMIL (b. 1843), an Austrian novelist, son of a Polish Jew, was born in Russian Podolia, and educated at Czortcow, Galicia, which he left to study law at Gratz and Vienna. For a few years he practised at the bar in the Austrian capital, but subsequently supported himself by journalism. He gave a popular description of his travels in *Semi-Asiatic Life: Pictures of Civilisation in Galicia, the Bukovina, South Russia, and Roumania*, and wrote many novels dealing with Jewish life. Chief among these are *The Jews of Barnow*, translated into English by M. W. Macdonald in 1882; *For the Right* (translated in 1887); and *Tragische Novellen* (*Tragic Tales*).

Fraoucen (AIT-FERAUSEN), one of the chief Berber tribes in Great Kabylia, province of Algiers, Algeria. They are members of the powerful Beni-Raten confederacy, and dwell E. of the Beni-Raten proper, in the Sebau basin and the surrounding hills. The tribal name *Fraoucen* has wrongly been identified with "France," giving rise to a local tradition of their French descent. It is really of great antiquity, occurring in Pliny under the form *Pharusii*, a Gætulian tribe; and, according to Hanoteau, they are the *Frazinenses* mentioned in some Numidian inscriptions. Since the third century they have occupied their present territory, where they number about 8,000 souls.

Fraser, JAMES, D.D. (1818-1885), second Bishop of Manchester, was at Shrewsbury under Dr. Butler and Dr. Kennedy; as a scholar of Lincoln College gained the Ireland scholarship at Oxford, and held a fellowship at Oriel from 1840 to 1847, when he was ordained and appointed to a college living. He was a member of two Royal Commissions on Education, and in 1865 was sent to report on the American system. He also assisted in the inquiry of 1867 relating to the employment of women and children in agricultural work. Appointed Bishop of Manchester by Mr. Gladstone in 1870, he won universal respect in spite of his conflict with the Ritualists, and in the industrial struggle of 1877-79 acted as mediator. His life was written by Thomas Hughes (1887).

Fraser River, in British Columbia, rises from several heads in the Rocky Mountains, between long. 115° and 119° W., and lat. 55° and 54° 30' N. One main branch flows north-west and the other south-east, till they meet at Fort George (lat. 54° N., long. 122° 45' W.), from which point the united stream flows to the south, and after a course of between 700 and 800 miles, falls into the Georgian Gulf, south of Vancouver Island. There are rich gold beds in the lower basin of the river, which is navigable for about 100 miles, and large quantities of salmon are taken from it. At Yale begin the rapids, and the scenery for some distance is very fine.

Fraticelli (*Fratres Minores*, Little Brothers) was originally the name which the people gave

to the Franciscans (q.v.). It was next applied to the stricter section of that order; but it was ultimately used to designate a party of seceders from the Roman Church. Pope Celestine V. granted to the Fraticelli a separate organisation; but Boniface VIII. suppressed them. Thereupon they declared the Head of the Church an apostate. They gained strength by further secessions, and rejected all attempts at conciliation. They refused to recognise the authority of the Church, and held peculiar doctrines—such as the unlawfulness of oaths, and the forfeiture of spiritual authority through sin. They suffered much persecution, and continued to exist till the end of the 15th century. In 1374 there was a public discussion at Perugia between them and Paolucci, a Franciscan monk. The Fraticelli paid almost divine honours to St. Francis, but were supposed to accept the works of Joachim of Flora, a Benedictine, as their gospel.

Fraud. The term "fraud" is used in very many senses, but one incident common to all of them is the obtaining, or attempting to obtain, pecuniary or other advantage by unfair means.

1. *Actual fraud* is where one person causes injury to another by suppressing or misrepresenting a material fact which, from the circumstances of their relative position, he was bound to explain or disclose. This kind of fraud is sometimes designated "moral," as distinguished from legal or constructive fraud. The effect of this description of fraud is often counteracted by the conduct of the defrauded person, as, for instance, where he has not relied on the representation or misrepresentation, or where he has shown gross negligence.

2. *Constructive or legal fraud* applies to cases in which a court will enforce or set aside a transaction in which it is of opinion that it is wrong for a person to avail himself of the advantage he has obtained. This class of fraud sometimes exists where no wrongful intention is proved.

3. *Fraud on third persons* exists where one enters into agreement or obligation with another, and simultaneously or afterwards acts without his knowledge in such a way that the benefit of the agreement is partially or wholly lost to him.

4. *Fraud by statute.* Certain acts are made frauds by Act of Parliament. Thus, by the "Companies Act, 1867," a prospectus which does not comply with the requirements of the Act in specifying all contracts entered into by the company, or promoters, trustees, or directors thereof, before the issue of the prospectus, is to be deemed fraudulent. This is a case of legal fraud in which proof of fraudulent intention is not required.

The effect of fraud generally entitles the injured person to avoid the particular transaction in which it occurs.

5. *Criminal fraud.* There are also certain frauds dealt with by the criminal law, under which they are constituted misdemeanors; such are frauds committed by public officers in discharge of their duties and affecting the public, frauds committed by trustees, directors, and other officials.

Fraunhofer, JOSEF VON (1787-1826), the discoverer of the dark lines in the sun's spectrum

which bear his name, was born at Straubing, Bavaria. In 1818 he became manager of an optical institute, at which he had been employed for some years. It was removed from Benediktbeuern in 1819 to Munich, where, four years later, Fraunhofer was made professor and conservator of the physical cabinet of the Academy of Sciences. Besides the discovery mentioned above, he was the author of several inventions and improvements in optical instruments and the mechanism of large telescopes, and made the great telescope at Dorpat.

Fraunhofer Lines are dark lines crossing the solar spectrum or that of any other source of mixed light that is partially screened by an intervening gaseous medium. The simple spectrum of sodium gives two characteristic yellow lines close together. If white light containing that yellow be passed through a prism, it will be split up and will exhibit in a band the range of colour from red, through yellow, to the violet. But if the same light be surrounded with sodium vapour, that special yellow constituent of the mixed light will be absorbed in the gaseous envelope and will be absent from the spectrum, two black lines occupying exactly the same positions that the bright yellow held previously. Experiments of this kind have conclusively shown that the Fraunhofer lines indicate the substances present as gas in the intervening medium. In the case of the sun, this medium is the gaseous envelope surrounding the denser mass within. It is seen by the multitude of lines in its spectrum to contain many of the substances present on earth, such as sodium, potassium, calcium, iron, gold, silver, etc. The same principle is employed to compare the compositions of the various stars or other heavenly bodies that emit light. [SPECTRUM ANALYSIS.]

Frechette, LOUIS HONORÉ (1839-1908), Canadian writer, born at Lévis, Quebec, called to the bar, 1864, and ten years later became a member of the Dominion Parliament. He has written poems (*Mes Loists, Les Oubliés, Voix d'Outre-mer* [1886]), plays, and other prose works. Two of his poems were crowned by the French Academy in 1880.

Freckles (*ephelis* or *lentigo*), small pigment spots which occur in fair people, usually on the face or backs of the hands. They are never found in very young children. They are popularly supposed to be produced by the sun, and are certainly more marked in summer than in winter. They are of no evil import, but on account of the disfigurement they sometimes cause various lotions have been employed with the object of effecting their removal. It is very doubtful whether such applications are of any value.

Fredegonde (d. between 596 and 598), Queen of Neustria, is notorious for her many crimes. She became the wife of Chilperic I., after she had obtained the repudiation of his first wife, and the death of Galeswinthe. The latter was sister of Brunhilda (q.v.), wife of Sigebert, who had suggested her to his brother as second wife. When war broke out between the brothers, Fredegonde put an end to it by the assassination of the King of

Austrasia. Others of her victims were Mérovée, who had married the widow; Andovère, his mother, first wife of Chilperic, and finally her husband himself. Brunhilda she pursued relentlessly, but could not take her life.

Frederick, the name of seven Danish kings. **FREDERICK III.** (1609-70) was granted absolute power by the Diet in 1660, after which the crown became hereditary in his family. **FREDERICK IV.** (1671-1730) was engaged in a lifelong war with Sweden, whose territories in North Germany he invaded. **FREDERICK V.** (1723-66) increased the trade of Denmark by the establishment of an Asiatic Company and by making the American trade free to all his subjects; while he also encouraged the arts and sent an exploring expedition to Egypt and the East. **FREDERICK VI.** (1768-1839) came to the throne in 1808, after having been Regent some years, during which time he joined the Armed Neutrality and the Continental System, and saw his capital bombarded in consequence. He supported Napoleon throughout, and had to cede Norway in 1814 to Sweden. In his reign serfdom was abolished, and the slave trade in Danish colonies prohibited. **FREDERICK VII.** (1808-1863) succeeded Christian VIII. in 1848, had to acknowledge the independence of Schleswig-Holstein, and abandoned the Sound dues for a sum of money.

Frederick, 5th Elector-Palatine (1596-1632), married Elizabeth, daughter of James I. of England, and was encouraged by him to accept the crown of Bohemia in 1619. He became head of the German Protestants, and the Thirty Years' War followed. He was driven out of Bohemia in a single winter, and put under the ban of the Empire, and the Palatinate went to Bavaria till the Peace of Westphalia.

Frederick, PRINCE OF WALES (1707-51), was the eldest son of George II. and father of George III. As George II. had quarrelled with his father, George I., in like manner Frederick quarrelled with George II., and became the head of the Opposition to his Government. This pitiful figure was the model for Bolingbroke's "Patriot King."

Frederick I., called "BARBAROSSA" (d. 1190), Emperor of the Holy Roman (Old German) Empire, was born between 1121 and 1123, and succeeded his uncle, Conrad III., in 1152, having been Duke of Suabia since the death of his father in 1147. After subduing several towns in Lombardy, he was crowned at Rome in 1154. Four years after he took Brescia and Milan, and at the Diet of Roncaglia was acknowledged as suzerain by the Lombard towns. His vassals and the Popes continued, however, to give him trouble in Italy, and even after the fortifications of Milan had been razed (1162) fresh revolts broke out. His defeat at Legnano (1176) induced him to adopt a policy of conciliation. He acknowledged Alexander III. as Pope in the following year, and in 1183 Italy was finally pacified. In the intervals of his wars with the Popes and his Italian subjects, Barbarossa had to encounter opposition in Germany. This he triumphed over by a mixture of firmness and conciliation. He made Austria a duchy and Bohemia a kingdom to

please their rulers, but he reduced to submission Henry the Lion of Bavaria, and asserted his feudal superiority over Poland, Hungary, Denmark, and Burgundy. He had in his youth been on crusade, and in 1188, when an old man, he once more took the cross. He never, however, reached Palestine; for, having defeated the Moslems at Philomelium and Iconium in Asia Minor, he was drowned while crossing a river in Pisidia. Frederick Barbarossa is one of the greatest national heroes in Germany, and there is a legend that he is still sleeping in the mountains of Thuringia, and will awake to deliver the Fatherland in the hour of her need.

Frederick II. (1194-1250), grandson of Barbarossa, and son of the Emperor Henry VI., was born near Ancona. His mother was heiress of Sicily, of which Frederick was acknowledged king by her submitting to the feudal superiority of the Pope. Innocent III. also favoured him by excommunicating Otto IV. in 1211, when he became Emperor. With the succeeding Popes, however, his relations were very different. Though he was crowned at Rome in 1220, the Emperor delayed for some years his promise to take the cross, in order to subdue the Italian nobles and his Sicilian subjects, and in 1227 was excommunicated by Gregory IX. for returning under plea of sickness. Next year, however, he at length arrived in the East, extorted from the Sultan of Egypt Jerusalem and the holy places, and crowned himself king of the city with his own hand. Having made a truce for ten years, he returned to Europe in order to oppose the Pope's designs in the south of Italy. Revolts followed in Lombardy and Germany, the latter headed by the Emperor's own son Henry, supported by the minister Peter de Vincis, and in 1239 Frederick was again excommunicated. In 1245 his subjects were absolved from their allegiance by Innocent IV., and a year after the capture of his only supporter, his natural son Enzo, he himself died. His object had been to reduce the Popes to their original spiritual functions, and he failed. That he was one of the greatest princes of the Middle Ages there can be no doubt; and he was no mere warrior or even statesman. To his contemporaries he was the wonder of the world, and the marvellous transformer! He spoke all the languages of his Empire, was the earliest of the Italian troubadours, and a student of natural science. He tolerated Jews and Mahometans, though he persecuted heretics. He founded universities at Vienna and Naples, and encouraged poets and artists. His ideal was an intelligent autocracy, based on a uniform code of laws giving security to the mercantile classes, who were, however, to have no political power. He was licentious and cruel, but not ungenerous. By his enemies he was accused of being an atheist. He married, in 1235, Isabella, daughter of John, King of England.

Frederick III. (1415-1493), son of Ernest, Duke of Austria, was elected King of the Romans in 1440, and crowned Emperor and King of Lombardy twelve years later. In the course of a long and apparently disastrous reign he lost Hungary, Bohemia, and Milan. Notwithstanding this, he

laid the foundation of the future greatness of the Hapsburg house by marrying his son Maximilian to Mary of Burgundy, their descendants almost realising his device, "*Austria est Imperare Orbi Universo*" ("It is the fate of Austria to rule the world").

Frederick I., King of Prussia (1657-1713), was born at Königsberg, and succeeded his father, Frederick William (q.v.), in the electorate of Brandenburg in 1688. He increased his territory by purchase, and was rewarded for his support of the grand alliance against France with the title of first King of Prussia, which he assumed in 1701.

Frederick II., called *the Great* (1712-1786), whose father was Frederick William I. (q.v.) and mother Sophia Dorothea, daughter of George I. of England, was born at Berlin. In his youth he fell into great disgrace because he wished to devote some of his time to other things beside those military exercises which the king considered as the whole duty of a prince. So harshly was he treated in consequence that in 1730 he concerted with his friend Lieutenant Katte an escape to England. The result was disastrous; Katte was executed, and the young prince, barely escaping with his life, was imprisoned at Küstrin. Frederick soon thought it best to submit, and was rewarded by being allowed more freedom in the little court at Rheinsberg, where he resided after his marriage in 1733 with the Princess of Brunswick-Wolfenbüttel. Here he corresponded with Voltaire, studied other French writers, and composed music. On May 31st, 1740, he became king, and soon showed that his studious tastes had not unfitted him for the sterner pursuits of an ambitious ruler. Frederick William had left him a highly-efficient army and a carefully-hoarded treasure. With these he immediately began his long struggle with Austria. After a short and sharp campaign, he gained possession of the greater part of Silesia by the treaty of Breslau (1742), and in a second war (1744-45) obtained the rest. Frederick had already shown himself to be at least as great a commander as any of his ancestors; and in the Seven Years' War, which followed after eleven years' peace, he displayed extraordinary ability. Instead of having to fight with a young princess taken by surprise, and but faintly supported by her own subjects, with her hereditary foe as his ally, he had now to defend his own dominions against the combined attack of Austria (with the Empire at her back), France, Russia, Sweden, and Saxony, England alone affording him some slight diversion from the west. The victories of Rossbach (November, 1757) over the French, Leuthen (December, 1757) over the Austrians, Zorndorf (August, 1758) over the Russians attested his prowess, and he showed marvellous fortitude and resource after the terrible disasters at Hochkirchen (October, 1758) and Kunersdorf, 1759). In 1762 circumstances delivered him from the enmity of the northern powers, and the Peace of Hubertsbourg (1763) secured his position. He gained a further increase of territory in the first partition of Poland (1772) and in the Bavarian campaign of 1778, and

had at his death raised Prussia from a second-rate to a first-rate power.

As regards internal government, he encouraged manufactures by a heavy protective tariff and by welcoming skilled artisans from other countries; while he attended himself to the minutest details of administration. The legal system was thoroughly organised, and Frederick saw that justice was done to all his subjects. A large measure of toleration in religion was granted. The strength of the army was increased, and the finances were carefully nursed. Taxation was remitted where it was seen to be too great a burden. By the formation of the Fürstenbund ("League of Princes") in his last years, Frederick assumed the position of head of Northern Germany, and began the process which ended in 1866, when Prussia took the place of Austria as first German power.

Frederick the Great was popular in England, which he visited in 1744, as "the Protestant hero;" but he was in reality a Deist, strongly imbued with the writings of the *philosophes*. In fact, he was thoroughly French, always using that language in his writings, and utterly neglecting German literature. His works fill thirty-one volumes, and consist chiefly of historical memoirs. An edition of his *Political Correspondence* was published at Berlin in 1878. He was undoubtedly the greatest monarch of the 18th century; but his success cannot blind us to the unscrupulous ambition, as well as ingratitude (for to her father he owed his life) of his attack upon Maria Theresa, or to the meanness of his personal conduct towards Voltaire. There are long German biographies of Frederick by Preuss, Droysen, and Kugler, the last of which has been translated; while his life may be read in English in the *Life* by Carlyle, the history of his reign by Tuttle (1888), and in one of Macaulay's *Essays*.

Frederick III., King of Prussia, and second Emperor of Germany (1831-1888), was the son of the Emperor William I. (q.v.) and the Empress Augusta. He was born at Potsdam, and educated by Dr. Curtius and the Rev. W. Godet, while he afterwards studied at Bonn, and travelled. Moltke was his teacher in things military. In 1858 he married the Princess Victoria, eldest daughter of the Queen of England, soon after which he began to take part in public affairs. Thus in 1863 he wrote a letter of protest to his father against the measures of Bismarck (q.v.) dealing with the army and the press. He began his military career in the Danish War, and in the war of 1866 with Austria commanded the Second Army, whose base of operations was Silesia. In the Franco-German War, the Crown Prince, in command of the Third Army, won the victory of Woerth, and took part in the battle of Sedan and the siege of Paris. He had much to do with the formation of the new German Empire, and was Regent during the illness of his father in 1878. He was present at the Jubilee celebration in London in 1887. In March, 1888, he became Emperor of Germany, but was cut off in his prime on June 15th by cancer in the throat. The Emperor Frederick did not work harmoniously

with Bismarck, who threatened to resign if he did not abandon the marriage which he proposed between his daughter and Prince Alexander of Battenberg. His views were more constitutional than those of any preceding Prussian king; he was opposed to the persecution of the Jews, and he shared in the liberal religious opinions and literary tastes of his wife. He has been called "Frederick the Noble."

Frederick Charles, PRINCE (1828-85), was the nephew of the Emperor William through his father and of the Empress Augusta on his mother's side. He commanded the right wing of the Prussian army in the Danish War of 1864, won the battle of Sadowa in 1866, and, as head of the Second Army in the Franco-German War, conducted the operations which led to the surrender of Metz, after which he defeated the attempt of Chanzky to relieve Paris from the south. He was called the "Red Prince" from the colour of his favourite uniform. The Duke of Connaught married one of his daughters.

Frederick William, Elector of Brandenburg, called "The Great Elector," (1620-88) was the first great man of the Hohenzollern family. Becoming Elector in 1640, he devoted his early years to repairing the ravages caused by the Thirty Years' War. By the Peace of Westphalia (1648) he lost part of his dominions, but in 1657 he secured the freedom of the duchy of Prussia from Poland. During the years 1672-79 he was engaged in a war with France and Sweden, and, though he drove the latter from Brandenburg, he was deserted by his allies, and obliged to pay an indemnity to Louis XIV. Nevertheless, at his death he left Brandenburg in the position of second German state, with a small but highly-efficient army, sound finances and the germs of trade. He revenged himself on France by receiving 20,000 refugees, who left her after the revocation of the Edict of Nantes, and who brought with them their industrial skill. He encouraged agriculture, opened canals, and set on foot a postal system. The royal library at Berlin was his foundation, and the capital of Prussia owes much to him besides. In religious matters he was tolerant. To sum him up, he was an earlier type of Frederick the Great.

Frederick William I., King of Prussia (1688-1740), the father of Frederick the Great, and the son of Frederick I., came to the throne in 1713. The first seven years of his reign were occupied in war with Sweden, from which power he gained Stettin at the peace; but during the remainder he was able to collect and drill tall soldiers without having to risk their precious lives. All his energies were employed in this, and in accumulating that hoard which his son afterwards found so useful. He was a mere martinet; but a martinet at the head of 80,000 men was invaluable to the rising kingdom of Prussia.

Frederick William II. (1744-97), nephew and successor of Frederick the Great, inherited none of his qualities. He dissipated the treasure left him by his uncle in a war undertaken in favour

of his brother-in-law, the Stadtholder of Holland, and alienated his subjects by heavy taxation and by interference with freedom of thought and religion. He gained territory, including the long-coveted Dantzic and Thorn by the second and third partitions of Poland (1793-95), but he was unsuccessful in obtaining any from France as he had hoped to do by attacking the revolutionary government.

Frederick William III. (1770-1840), son and successor of the last-named, was an amiable man, but not an able ruler. Up to the year 1806, partly owing to jealousy of Austria, partly to the hope of obtaining Hanover, and partly from natural timidity, he took no part in the coalitions against Napoleon. When he was at length forced into action by the indignation of his subjects at the violation of their territory, and by the spirit of his Queen (Louise), it was too late. Prussia, with a disorganised army and alone, was speedily crushed at Jena and Auerstadt, and was brought lower than she had been for a century. After a time, however, the army was secretly reorganised, and Stein (q.v.) was summoned to advise on civil matters; so that when the Russian campaign had brought down the pride of Napoleon, Prussia was ready to join with the Allies in the War of Liberation. Frederick William, as a true Hohenzollern, accompanied the army in person, and at the end of the war not only recovered his lost possessions, but gained part of Saxony, Jülich and Berg, and Swedish Pomerania. The peace was followed by a short period of reform; but from the year 1818 arbitrary government prevailed in Prussia, as in Austria, and, to some extent also, in France. Frederick William joined the Holy Alliance; assisted Russia to suppress the rising of the Poles; and suppressed freedom on the platform and in the press. He was a well-meaning and hard-working, but weak king.

Frederick William IV. (1795-1861) was the eldest son of Frederick William III. He was carefully educated, and became a well-read man, with some taste for art and oratorical ability. When he came to the throne he called the constitutionalists Eichhorn and Boyen to his councils, but soon disappointed the hopes which the Liberals had formed of him. In 1847 he refused a written constitution, but yielded to the revolutionists of 1848. Next year he wisely rejected the Imperial crown offered him by the Frankfort Assembly. In 1850 he promulgated the Prussian Constitution, but always evaded a liberal interpretation of it. In foreign affairs he leaned towards Russia, having a great regard for the Tsar Nicholas, his brother-in-law. In 1857 he became insane, and the Regency was entrusted to his brother William, afterwards King and Emperor.

Frederickshald, a fortified town on the coast of Norway, eighty-five miles S.S.E. of Christiania. It was formerly called Halden, but takes its present name from Frederick III. of Denmark. It was burnt down in 1826, and has been rebuilt with broad streets in the modern style. The timber trade employs the inhabitants. **Charles XII.** of

Sweden was killed (1718) while besieging Frederiksteen, situated to the south-east of the town.

Free Church of England, THE, a small body of Evangelicals who separated in 1844 from the Anglican Church, as a protest against the Tractarian movement.

Free Church of Scotland, THE, is an offshoot of the Established Church, formed by the disruption which took place in 1843. Patronage had been restored in 1712, though the "call," or actual election as pastor, was still to be in the hands of the parishioners. In 1834 the General Assembly of the Church passed a Veto Law, which laid down as a fundamental doctrine that no minister could be intruded into a parish against the will of the church members, and declared that a majority of male heads of families, being full members of the church, should be able to prevent such intrusion of a presentee. Litigation followed, and came to a head in the Auchterarder case, where the majority of the parish had been opposed to the call of a presentee made by two heads of families. The Court of Session declared the appointment legal under the Patronage Act, and was upheld by the House of Lords. The consequence was that, in 1843, Dr. Chalmers with 420 other ministers left the hall of the Assembly, and constituted themselves the General Assembly of the Free Church. Most of their congregations followed, and in four years they had 700 churches. The Free Church maintained the doctrine of the body from which they had seceded; and the ability of their first Moderator, Dr. Chalmers, soon gained them a secure position in Scotland. In 1863 negotiations for union with the United Presbyterian Church were begun, and ten years later a working agreement was arrived at by which a "mutual eligibility" of ministers from all the negotiating churches was declared. In 1874 the Cameronians were united to the Free Church. In 1900 union between the Free Church and the United Presbyterians took place, being voted unanimously by the U.P. Church and by a vote of 643 to 27 by the Free Church Assembly. The minority claimed to represent the original Free Church, and appealed to the law, which decided in their favour. In 1905, an Act of Parliament was passed under which an Executive Commission was set up to allocate the property between the two Churches. [UNITED FREE CHURCH OF SCOTLAND.]

Freehold is literally "the holding of a free-man," and the estate of a freeman was originally for his own life only; but from a very early period freehold estates of larger quantity existed (*i.e.* estates of inheritance either in fee simple or fee-tail). Still, the original quality of the freehold is discernible in the following well-known and accurate definition: "An estate of freehold is any estate of uncertain duration, which may possibly last for the life of the tenant (*i.e.* the possessor) at least." [ESTATE, FEUDAL SYSTEM.]

Free Imperial Cities (*Freie Reichsstädte*), German towns which were immediately under the Emperor, which exercised free jurisdiction within their territories, and which had an independent

position in the Diet or Assembly of the Empire. Their privileges were acquired either by special grant, by purchase, or by force of arms. Their numbers fluctuated considerably, as they were liable to lose their position in the same way as they had gained it. For some time they were judicially under imperial officers, a *Reichsvogt*, or imperial criminal judge, and a *Reichsschultheiss*, or imperial civil procurator. These officers they subsequently elected themselves; and the authority of the Emperor, except on special occasions, became merely nominal. At the Diet of Augsburg (1554) the Free Cities were divided into two benches, the Rhenish and the Suabian; and at the peace of Westphalia (1648) they were formed into the third collegium of the Imperial Diet. At the time of the French Revolution they numbered fifty-one, Cologne, Aix-la-Chapelle, Frankfort-on-the-Main, Hamburg, Bremen, and Worms, being the chief among the Rhenish cities; and Ratisbon, Nuremberg, Augsburg, and Ulm, among the Suabian. On the dissolution of the Empire in 1806, Augsburg and Nuremberg went to Bavaria, and Frankfort became the capital of the Confederation of the Rhine. The latter regained her freedom in 1815, but lost it in 1866, since which time Hamburg, Lubeck, and Bremen have been the only Free Imperial Cities. These last have now, by joining the Imperial Customs' Union (*Zollverein*), surrendered the title so far as financial matters are concerned.

Free-Lances or FREE COMPANIES were bodies of knights and men-at-arms who roved about Europe in the Middle Ages offering their services to the highest bidder. Among the more famous of these bands were the Austrian *Landsknechte*, who were originally raised in 1487, and continued to play a leading part in all the wars of the next two centuries; the Swiss mercenaries, who were found in every country and service; and the *Condottieri* of Italy.

Freeman is one who at birth inherits the rights and privileges of a citizen, as distinguished from a *freedman*, who is born a slave and has acquired freedom. In the United States the latter term was applied to the emancipated negroes. In corporations, a freeman is a person who has inherited or acquired by adoption, purchase or apprenticeship, the rights of a citizen. By the Municipal Reform Act (1835), persons who had hitherto enjoyed the right of voting were placed on the Freeman's Roll, while those who obtained privileges by virtue of the Act were placed on a separate list called the Burgess Roll.

Freeman, EDWARD AUGUSTUS (1823-92), an English historian, was born at Harborne, Staffordshire, and was elected scholar of Trinity College, Oxford, in 1841, becoming fellow in 1845. After having several times been an examiner, he was appointed Regius Professor of Modern History in the University in 1884 in succession to Dr. Stubbs. In 1868 he had been an unsuccessful Liberal candidate for Mid-Somerset, and was in after-years a firm Home Ruler. He early inherited an estate in Somersetshire, and was able to devote himself without interruption to

his favourite studies. His name will be remembered chiefly in connection with his *History of the Norman Conquest* (1867-76), and his doctrine of the *Unity of History* first propounded in the Rede lecture at Cambridge in 1872. Among his numerous other works were *The History and Conquest of the Saracens*, *The Reign of William Rufus*, and his *Old English History*; and he was at work upon a *History of Sicily* when he died of small-pox at Alicante. He was a high authority on the history of architecture, and was for many years a regular contributor to the *Saturday Review*, but resigned in consequence of the line taken by that paper on the Eastern Question in 1877. He took a prominent part in the agitation of that time against English support of Turkey against Russia. He was Hon. D.C.L. of Oxford, LL.D. of Cambridge and Edinburgh, and a knight of several foreign orders.

Freemasons were originally what their name, *Freemen Masons*, implies—namely, members enjoying all the privileges of the guild of masons. These craftsmen travelled about in order to take part in building, and were recognised and accorded hospitality after exchanging certain signs, which were known only to members of the guild. A master was at the head of the central organisation, and wardens presided over branches of it. In Germany the masons were not only builders, but also, to a large extent, architects. Modern, or as it is sometimes called "Speculative," Freemasonry has no connection with any particular trade, though the Scotch Lodges trace their origin to the masons who came from abroad to build the Abbeys of Melrose, Kilwinning, and Holyrood in the 12th century, and those of England to an assemblage of masons held by Æthelstan at York in 926. In reality they are of English origin, and date from the 18th century only. In England the two Grand Lodges were those of York and London, who disputed about precedence and other matters till, in 1813, they were united by the Dukes of Kent and Sussex, their respective Grand Masters. There is now one central governing body, called the "United Grand Lodge of Ancient Free and Accepted Masons of England." The Duke of Connaught is its Grand Master; and besides his deputy, its officers include Grand Wardens, provincial Grand Masters, Masters and Wardens of Lodges, and annually-elected stewards. There is every year a masonic festival, and the stewards meet four times during the same period for business purposes. The object of existing English freemasonry is "the practice of moral and social virtue," and, above all, mutual relief. A freemason becomes first an "apprentice," next a "fellow-craft," and, lastly, is admitted as "master-mason." A set of pass-words and a peculiar way of shaking hands enable freemasons to recognise one another. The Grand Lodge of Scotland dates from 1736, and has now more than 600 branches. That of Ireland, founded in 1730, has 900 lodges under it. Freemasonry has been introduced into India, China, and the Colonies, and in the United States flourishes greatly, having nearly 10,000 lodges. On the Continent it has been used as a political agent, and has been condemned

by five Popes as subversive both of religious and civil authority. It exists, nevertheless, in every country of Europe. In England it has never been regarded as revolutionary, and when in 1799 the Act for the suppression of secret and unlawful societies was passed, freemasons' lodges were expressly excepted from its operation. Encyclopædias of freemasonry have been published both in German and English, as well as many other works on the subject.

Free Path, in molecular *Physics*. The kinetic theory of gases regards each molecule of gas as being endowed with a definite speed, and as rushing about in an irregular course dependent on the number of collisions it has with other similar molecules. It travels in straight lines, which alter their direction when oblique impact occurs. If the mass of gas be at a definite temperature, the speeds of the constituent molecules will all approximate closely to a definite average; and though each is behaving differently, the length of straight-line path between successive collisions will also approximate to a definite average length. In dealing with the mass of gas as a whole the value of these averages is required, rather than the individual values for a given molecule. They are called respectively the *velocity of mean square*, and the *mean free path*, for the given gas.

Free Port is a port at which all vessels may load or unload without being subject to any customs or other duties, except harbour dues. They were established in the Middle Ages by France, Spain, Austria, Portugal, and the Italian States, and in the 18th century, when protective tariffs had become frequent, were of particular importance. The system of bonding soon, however, took their place, and few Free Ports survived long in the 19th century. Trieste and Fiume on the Austrian shores of the Adriatic, and Hamburg and Bremen on the North Sea, were free ports till quite recently. Hong-kong, Singapore, Amboyna, St. Thomas, and a few other places are still centres of this kind, their chief use being as entrepôts where commodities destined for distant markets may be more easily exchanged.

Free Trade, in the largest meaning of the phrase, consists in the liberty of individuals to buy and sell commodities of all kinds in such markets and at such prices as they think advantageous for themselves. Owing to historical circumstances, the expression has become limited to international commerce, and can be applied to the domestic trade of a country only in the qualified form "internal free trade." As attempts on the part of Governments to regulate foreign commerce now usually take the form of indirect encouragement or discouragement of exportation and importation respectively, Free Trade is best defined under its negative aspect as the "absence of artificial restraints on international exchange." When customs duties do not have this effect, but merely furnish a source of revenue, they do not interfere appreciably with freedom of trade.

The economic advantages of universal Free Trade

was generally accepted in England up to recent years, when exponents of a Preferential Tariff, led by Mr. Joseph Chamberlain, acquired a strong following. England, before "Free Trade," was under the sway of the Mercantile System, and strove to obtain the exclusive advantages which foreign trade, when judiciously managed, was supposed to bring. Chief among these was a plentiful supply of the precious metals, for the command over all kinds of wealth exercised by money as the medium of exchange, and the fact that the value of wealth is measured in money, had led to the notion that money is identical with wealth, or, at any rate, is the most desirable form that wealth can take. Stress was laid on the importance of a large stock of specie on which the sovereign could draw for his foreign wars and other extraordinary expenses. The main aim of the Government, therefore, was to secure a "favourable balance of trade"—i.e. an excess of exports over imports—and for this purpose exportation was encouraged by bounties and drawbacks, while differential duties were placed on goods imported from foreign lands. The same policy was pursued in the negotiation of commercial treaties and the treatment of colonial dependencies. [MERCANTILE SYSTEM.] The Mercantile Theory gradually fell into disrepute, partly owing to the practical experience of merchants, but mainly through a closer study of economic questions. Adam Smith's *Wealth of Nations* (1776) was the first work that displayed a firm grasp of the subject in all its bearings. His advocacy of Free Trade is based on three main arguments. In the first place, he struck at the root of the Mercantile System by showing that not only does money not constitute wealth, but little gold and silver change hands in the course of international commerce. Imports are paid for by exports, through the medium of bills of exchange. In like manner, when it is desired to transfer wealth from one country to another, it will naturally take the form of commodities rather than that of bullion. During the war with France a merchant who undertook to supply money abroad for the payment of the English troops would do so by drawing a bill on a foreign correspondent and exporting goods to the amount, the only way in which he could benefit himself by the transaction. Thus the troops were paid out of the "money of the mercantile republic," which circulated more about the seat of war; for money obeys the same law as other commodities, and flows to those places where it is most in demand. In the second place, Adam Smith dwells on the beneficial effects which result from applying the principle of Division of Labour to international commerce. Just as the specialisation of industry in a single community, by economising time and skill, leads to the production of more wealth, so the sum total of wealth in the civilised world would be increased if the people of each country always followed those trades in which the natural products of the soil and their own acquired capacity give them the greatest advantages. By freely exchanging the surplus of their respective products, all countries would derive equal benefit from the new wealth thus created. But

trade will never flow into the channels necessary to effect such a result while a false direction is given to it by the interference of the State. Self-interest appeared to Smith to be the true source of economic progress, for he believed that the individual, in seeking his own advantage, unconsciously promotes the welfare of the community to which he belongs. The direction of commerce should therefore be left to private traders, since each is a better judge than the State can be of the course most adapted to further his own interests. We are thus led from Smith's great positive argument to his negative argument, in which he maintains that the State never has, as a matter of fact, succeeded in procuring for a nation those advantages which it professed to have in view. Subsequent writers have done little more than amplify these two arguments, which must be regarded as economically true, even by those who deny the salutary effects of "natural liberty" in the sphere of morals or politics.

Adam Smith's work made a deep impression on thoughtful politicians, and in Pitt he found a disciple who was anxious to remodel the fiscal policy of the nation in accordance with his views; but Pitt's plans of reform were cut short by the outbreak of the French war, which gave full scope to the growth of vested interests and left behind it a strong feeling against any proposals that savoured of Free Trade. This feeling was not shared by the manufacturers and traders. In 1820 petitions for Free Trade were presented to Parliament by the London merchants and the Edinburgh Chamber of Commerce, and the report of the Committee appointed to examine them commented favourably on the views which they contained. The way was thus paved for the first instalment of reform, which was carried out by Huskisson as President of the Board of Trade (1824-27). His measures included a reduction of the duties on raw silk and wool, and the establishment of Free Trade between Great Britain and Ireland. The work of reform was resumed by Peel in 1842. There were then 1,150 items on the tariff, but 10 articles produced £20,871,136 out of a total revenue of £22,962,610. Besides lowering prohibitive duties so as to make them productive of revenue, Peel aimed at reducing those on raw materials to a nominal amount, and subjecting manufactured articles to duties averaging 20 per cent., which would not exclude foreign competition. In 1845 the duties on silk, cotton, and other raw materials were abolished, and the differential duties on sugar were considerably reduced. Peel displayed his usual caution in attempting a gradual reform of the tariff, chiefly in those directions where it would arouse the least opposition; but subsequent events showed that he overestimated the strength of the great protected interests, and the credit of establishing Free Trade has fallen to Cobden and others, who had the courage to adopt a bolder course. [CORN LAWS.] After the repeal of the Corn Laws (1846), which involved the surrender of the landed interest at home, the colonial and shipping interests could not long hold their ground. The duties on foreign and colonial sugar and timber were gradually equalised, and converted into revenue duties, and the attempt to keep the

carrying trade to England in the hands of British subjects was abandoned. [NAVIGATION LAWS.] The reform of the customs was completed by Mr. Gladstone in 1852-53 and 1860, when the protection of manufactures entirely ceased, and all differential duties and nearly all those on food-stuffs were abolished. Our commercial treaty with France in the same year gave a great stimulus to Free Trade on the Continent, where it had hitherto been confined to small States, such as Sardinia, Holland, and Belgium. The example set by France was soon followed by the Zollverein or Customs Union of the German States, and in the course of a few years treaties were concluded between all the chief European countries. They generally contained a provision, known as the "most favoured nation clause," stipulating that any commercial privileges granted by one of the negotiating parties to a third Power should be extended to the other party. This promoted Free Trade by creating a "conventional" tariff, as opposed to the ordinary tariff, which, owing to the number of treaties, would seldom need to be applied.

It seemed as though the hopes of Cobden would speedily be realised, but during the last twenty years a reaction has taken place on the Continent, while the policy of the United States for the thirty years preceding the Presidential Election of 1892 has been increasingly and even fanatically Protectionist, and a strong leaning towards Protection has manifested itself in our own colonies. The reactionary movement on the Continent has been due, among other causes, to the growth of a stronger feeling of nationality, and the panic occasioned by the decline of agriculture, and the increasing stress of the competition between the manufactures of different nations. In so far as these are symptoms of a period of transition both in the economic and the political sphere, they may be regarded as disturbing influences of a temporary character, and a return to Free Trade may be looked for as soon as the political and economic stability which favour its progress have been restored. American Protection is to be ascribed in great measure to commercial ambition and the feeling of hostility to England, which originated in our attempts to check their industrial development, and led to the War of Separation. Protection naturally suggests itself to young countries, like our self-governing Australian colonies, as an easy method of hastening on their political and social development. It may sometimes have this effect, although the evidence so far does not tend to support the theory. The "political" arguments in favour of Protection carry great weight in America as well as in Australia, but, as they have only an indirect bearing on the general question of Free Trade, they cannot be discussed here. [PROTECTION.]

But those who support a restrictive policy for political reasons attempt at the same time to justify their action on economic grounds. They assert that "Protection gives employment," but employment requires capital, and the immediate effect of protection is merely to withdraw capital and labour from some undertaking in which they were profitably employed, in order to embark them

in another to which they were not previously attracted, because there was less prospect of success. It is indeed conceivable that the establishment of new enterprises under Government sanction might increase capital by encouraging saving, but experience shows that its growth has always been greater under a system of Free Trade. Capital is then rapidly diverted from a declining industry to the production of other goods for foreign markets, and the increased returns stimulate fresh accumulation; whereas Protection, by creating vested interests, tends to prolong its unproductive employment. Without examining the "Infant Industry" and "Variety of Industry" arguments on their political side, it may be well to point out some economic fallacies of a grosser kind involved in the assumption that a Government can benefit the community by giving an artificial direction to the investment of capital. The nominal earnings of those engaged in the favoured industries will at first be exceptionally high, while the real wages and profits of all other producers will be diminished, for they will receive a less amount of the protected commodities in exchange for their own products. They will exclaim that their treatment is unfair, and the Government will be obliged to resort to universal Protection, so that the values of all goods will return to their original balance. If it refrains from this course, and the protected industry, in spite of natural drawbacks, makes some progress, the high prices at first realised will soon be cut down by competition. A point will at last be reached at which it may fairly be contended that the duty should be withdrawn, but those who are benefited by it will not readily consent to its removal. Combinations of manufacturers and mine-owners to keep up duties exercise a disastrous influence on trade in the United States, and, it may be added, are also a powerful source of political corruption.

A more serious objection to Free Trade is brought forward by those who assert that, where the movements of capital are unfettered, it will tend to emigrate from old countries to lands where it can obtain a higher rate of interest; that labour, though more slowly, will follow the same course, and that thus the prosperity of a nation may be undermined. Adam Smith thought that everyone would, in his own interest, always prefer to employ his capital at home, but the danger and delay attending foreign investments have greatly decreased since he wrote. However, national feeling will probably always be strong enough to supply a country with as much capital as it really requires.

Free Traders aver that England has reaped so much benefit therefrom that she would not return to deliberate and systematic Protection. But during the reign of the late Edward VII. the question of "Tariff Reform" became an issue of the first importance, and many who, while they would not go so far, maintain that, since foreign countries persist in protecting their industries, England must do so also in self-defence. We should gain nothing by reducing our imports; these must always be paid for in exports, though the latter may fall short of the amount we desire.

The case against "fair trade," or "reciprocity," was graphically summed up by John Bright in his question, "whether two wrongs make a right?" Others recommend "retaliation" rather than "reciprocity;" they would tax imports, not because they think them injurious, but because they believe that by excluding the goods of foreign countries from our markets we should induce them to admit our own. Mr. Chamberlain revived the whole question by the introduction of his proposals for Preferential Tariffs in 1903, and the subject of Free Trade was once more eagerly discussed throughout the country. At the General Election in 1906, however, the country pronounced very unmistakably in favour of Free Trade, and this was largely the issue at the 1910 General Election.

Most Free Traders, while denying the necessity for reciprocity or retaliation, would allow that under certain circumstances it may be advisable to set aside their principles for a time. If, for example, it can be shown that the threatened exhaustion of our supplies of coal and iron, on which our commercial supremacy depends, can be averted by checking their exportation, a case is clearly made out for Government interference, either temporary or permanent.

Free Will. [WILL.]

Freezing means the solidification of a liquid. It is generally applied to water only, but is applicable to all other such cases. Freezing of water occurs at a temperature so nearly constant that it is regarded as one of the fixed points required for the graduation of thermometers. On the Centigrade scale it is marked 0°, and on the Fahrenheit scale 32°. It is found to vary slightly with changes of pressure, an increase in pressure lowering the freezing-point. One atmosphere increase lowers it by about .0075° C. This variation is far slighter than that of the boiling-point per atmosphere increase or decrease. Liquids, as a rule, contract on freezing; water is a rare exception, expanding as it does to the extent of one-eighth its liquid volume. It is on this account that increase of pressure lowers the freezing-point of water; such increase usually raises the freezing-point of other liquids, and renders the process of solidification possible at higher temperatures than before pressure is applied. Thus to effect solidification the temperature may be lowered, or pressure may be applied. Both means are adopted when the liquid is very difficult to freeze. Another resource is available when the liquid has to be kept under pressure to prevent vaporisation. The pressure is suddenly removed, vaporisation immediately begins, and, requiring heat for this change of state, it takes it from the bulk of liquid. Enough may be thus abstracted to effect the freezing of the remaining liquid. Salt water freezes at a lower temperature than pure water, the exact point depending on the quantity of salt present. At this point the water solidifies as almost pure ice, leaving the salt behind. Saturated brine behaves differently, freezing of part causing the remaining liquid to lose some of its salt. This fact of the lowering the freezing-point

of water by addition of salt is utilised in the formation of *freezing-mixtures* (q.v.). [COLD.]

Freezing Mixtures are mixtures of various substances employed for the production of low temperatures. Most depend upon the fact that when a solid liquefies, energy is in general absorbed, and hence the temperature falls. Thus, when potassium sulphocyanide is dissolved in cold water to form a concentrated solution, the temperature falls to -20° C. If ice, or snow, and salt be mixed together, a strong solution of brine is obtained, and the temperature sinks to -23° C. To obtain the greatest lowering, the proportions of ice and salt, by weight, should be about 3 to 1. If calcium chloride crystals be mixed with an equal weight of snow, the temperature falls to -45°, a point at which mercury solidifies. Also for the production of low temperatures, advantage is frequently taken of the fact that, if a liquid evaporates, energy is absorbed and heat disappears. If, therefore, the evaporation be rapid, the temperature will fall. In this way liquid CO₂ may be converted into a snow-like solid, which, when mixed with ether, forms a very powerful freezing mixture. By the rapid evaporation, also, of methyl chloride (a liquid boiling at -22° C.), extreme cold may be produced, and if a current of air cooled by this means be passed through liquid ethylene, the latter evaporates, and such intense cold is obtained as to cause the liquefaction of oxygen and ordinary air.

Fregilupus, an aberrant genus of Starlings, with a single species (*F. varius*). It formerly inhabited Réunion, but became extinct in the first half of the 19th century. There is a good specimen in the Natural History Museum, South Kensington.

Freiberg. A town in Saxony, midway between Dresden and Chemnitz, 20 miles W.S.W. of the former. Founded in 1175, the city has a cathedral, in which are tombs of the Albertine Electors of Saxony. Its mines, discovered in the 12th century, give employment to 6,800 men, and from them silver, bismuth, and other minerals are extracted. The school of mines, founded in 1765, is the first in Europe.

Freiburg, or **FRIBOURG**, a canton in Switzerland, situated between Berne and Vaud, while small parts of it lie inside the latter, the largest of these looking on the Lake Neuchâtel. The total area of the canton is 644 square miles, and the population is chiefly Catholic. French is spoken by about three-fourths, German by the remainder. Its surface is generally hilly, and in the south there are several peaks of upwards of 6,500 feet. The river Saane runs through the centre from south to north. On it stands Fribourg, the capital, where there is a very fine organ. Gruyère, where the cheese is made, is in this canton. At Morat, in the north, on the lake of that name, a small body of Swiss defeated Charles the Bold of Burgundy in 1476. Fribourg sends six members to the Federal Assembly.

Freiburg-in-Breisgau, a town in Baden, 32 miles N.N.E. of Basel. Its cathedral, begun in

1122 and finished in 1513, is a fine specimen of Gothic. It is built of red sandstone, and has an elegant steeple, 381 feet high. The university, founded in 1455, has more than 800 students and 80 professors, and a fine library. Among its manufactures are sewing silk, buttons, and paper. Freiburg suffered much in the Thirty Years' War, and has twice belonged to France. Here the Baden revolutionists of 1848 were defeated by the German Confederation.

Freight is, etymologically, "that with which a ship is *fraught*," viz. loaded. The term is, however, generally used of the price paid by the owner of a cargo for its carriage by the ship-owner. The terms of the agreement are stated in the Charter-party or Bill of Lading. Freight is usually not paid until the delivery of goods; but if it has been advanced, it is not recoverable, even though the cargo may have been lost or captured. Till the Merchant Shipping Act of 1854 it was held that the wages of the crew depended upon the freight being earned; and in America this is still the rule, though with important modifications.

Freiligrath, FERDINAND (1810-76), a German revolutionary poet, was born at Detmold, the son of a schoolmaster. He was almost entirely self-educated, being engaged in commerce from a very early age. In 1835 he suddenly gained a name by some poems contributed to Chamisso's *Musen-almanach*. Three years later his first volume appeared. In 1840 he married Ida Melos, who had inspired some of his best lyrics. Having by his *Confession of Faith* (a poem) offended the authorities, he went first to Belgium, and in 1846 to London, returning to Germany after the Revolution of 1848. *Die Todten als Lebenden* (*The Dead as Living*) caused him to be impeached, but he was acquitted. In 1851, however, he came back to London, and did not see the Fatherland again till 1868. While living at Hackney he gave his leisure to poetry, and translated Burns, Moore, and De Musset. In 1867, when he was ruined by the failure of the bank in which he was employed, his countrymen subscribed 60,000 thalers for his relief. Freiligrath was one of the most popular poets of the century. His earliest *Gedichte* have reached a forty-third edition, and his collected works a fifth. During the war of 1870 he wrote some stirring battle-songs.

Freischütz ("Free-shot"), the name of the marksman in a German legend, who makes a compact with the devil by which the latter gives him seven shots, all of which are sure to hit the mark but the seventh, the direction of which he reserves to himself. In the northern version it is a fowler who sells his soul in order that for seven years he may be certain of his aim. The libretto of Weber's opera, *Der Freischütz*, is founded on this legend.

Frelinghuysen, FREDERICK (1753-1804), an American statesman of Dutch extraction, took part in the battles of Trenton and Monmouth. Court-house, was a member of the Continental Congress in 1778 and 1782-83, and afterwards became a United States Senator. **THEODORE**, his second son

(1787-1861), was known as the "Christian Statesman" for his speeches in the American Senate. His nephew, **FREDERICK THEODORE** (1817-85), was Attorney-General of New Jersey between 1860 and 1870, and in the United States Senate carried a bill against polygamy. He was Secretary of State under President Arthur (1881-85).

Frémont, JOHN CHARLES (1813-90), an American explorer, born at Savannah, his father being a Frenchman. He became a civil engineer, and in 1842 explored the South Pass of the Rocky Mountains, and ascended the highest peak of the Wind River Mountains, which now bears his name. His report showed that an overland route from one side of North America to the other was practicable. In 1843 he explored the Great Salt Lake, and penetrated as far as Fort Vancouver. During the Mexican War he did good service, but was sentenced by court-martial to be dismissed the service for refusing to obey his superior officers. In 1848 he started on an expedition to the Rio Grande, but the guide lost his way, and only two-thirds of the party returned to Santa Fé (New Mexico) after terrible sufferings, which had caused a resort to cannibalism. Next year, however, Frémont reached California, where he became a senator of the newly-organised State. He conducted another expedition to the Rio Grande in 1853. In 1856 he was the unsuccessful Republican candidate for the Presidency, but in 1864 withdrew in favour of Lincoln. He was governor of Arizona in 1878-82. A scheme which he propounded for a South Pacific Railway caused him to be condemned for fraud by the French Government in 1873, but he did not appear at the trial. He published *Memoirs of My Life* in 1886.

French Bean, KIDNEY or HARICOT BEAN (*Phaseolus vulgaris*), a species of a genus of about fifty leguminous plants, mostly natives of tropical America, distinguished by the long spirally-twisted points of keel-petals of their flowers. *P. vulgaris* is distinguished by having only a few flowers on a stalk with ovate bracts below each of them. The whole plant is slightly pubescent; its leaves consist of three oval acute leaflets with angular petiolules swollen at their bases, and small stipules; the flowers are white, rose-coloured, or lilac; and the pod is pendulous, compressed, pointed, and from 3 to 6 inches long. It may be a native of Mexico, and is not certainly known to have been cultivated in Europe before the 16th century. In England the unripe pods are eaten; but in Catholic countries the ripe seeds are largely used as a Lenten diet, under the name of *haricots*. If not over-boiled, these seeds have valuable digestive and mildly aperient properties.

French Chalk is a variety of *steatite*, a hydrated silicate of magnesium, of varying composition. It is used for cleaning leather, silk, etc., for marking cloth, and owing to its smooth, soapy feel is also frequently used as a powder for the interior of gloves, boots, etc.

French Literature. The French language is of the Aryan stock of languages, through the

Latin, being one of the Neo-Latin or Romance tongues, which comprise the Portuguese, Spanish, French, Provençal, Italian, Romanisch or Ladin, and Roumanian. The ancient Gauls, however, were Celts, and it was only after many centuries that the all-conquering Romans were able to overpower the Celtic dialects by the *lingua romana rustica*. During the fifth century the Teutonic element was blended with the Gallo-Roman speech, and it left considerable traces of its presence in the popular vocabulary. The *lingua romana* as spoken by the masses was a rude, uncoined form of speech, but when written by the educated and ruling classes it retained much of the Ciceronian and literary spirit.

By the eighth century there was a clear line of demarcation as regards language between Southern and Northern France. The South was known as the country of the *langue d'oc*, or Provençal. The literature in this language was the earliest to flourish, but after a brief period of splendour it as quickly passed into a stage of decadence. The Southern troubadours of the eleventh and twelfth centuries were the poets of civilised society. They wrote *chansons*, or amatory poems; *complaintes*, or elegiac compositions; *tenons*, or *jeux-partis*, poetical discussions or debates on questions of love or war; *sirventes*, or satirical compositions; *pastorelles*, or eclogues, introducing two or more characters; and *ballades*. Several romances of chivalry were also written in the *langue d'oc*, and among other monuments of Provençal literature were a translation of Boethius's *De Consolatione* and a metrical chronicle of the Crusade against the Albigenses (1210). The first of the troubadours of whom we have authoritative knowledge was Guillem IX., Count of Poitiers; his successors are far too numerous to particularise. Out of some 400 troubadours there were only about twelve women singers. They were much inferior in merit to the male troubadours, though the most famous of them, the Countess Beatrix de Dia, has been styled the "Sappho of Provence." The Albigensian persecution of the thirteenth century practically destroyed Provençal poetry, as the lands of the nobles were laid waste, and Innocent IV. condemned the language as heretical and forbade its use by the clergy. The troubadour traditions feebly lingered, and in the first half of the fourteenth century an effort was made to revive the old poetry by the formation of a society of song at Toulon. Branch societies were formed in other places; but, in spite of poetic contests, they failed to revive the former brilliant spirit.

The language of the North, or *langue d'oïl*, was longer in attaining maturity, but it became more permanent. The poets of the *langue d'oïl* were known as trouvères. They were animated by a more earnest spirit than the troubadours; and just as it is claimed for the latter that they were the precursors and inspirers of Dante, Petrarch, and Boccaccio, so it is claimed for the trouvères that by their *chansons de geste* they inspired Ariosto, Tasso, and Chaucer, and, at a later period, Milton, Goethe, and Hugo. History, adventure, mythology, and Biblical narratives were the inspiration of the

trouvères; and they produced romances of chivalry, rhymed chronicles and chronicles in prose, fabliaux, apologies, lais, virelais, rondeaux, ballades, etc. The first celebrated French romance was the *Chanson de Roland*, an epic composed by a Norman trouvère in the eleventh century. Then there were the romances of the Round Table. There were also writers of mysteries, miracle plays, and moralities. The principal chronicles of the first part of the Middle Ages were the *Roman de Rou* and the *Roman de Brut* of Robert Wace; *La Conquête de Constantinople* by Villehardouin; the *Histoire de Saint Louis* by the Sire de Joinville; and the *Chronicles of Froissart*. Guillaume de Lorris began the *Roman de la Rose*, which was continued by Jehan de Meung. The *Roman du Renard* was at once the most comprehensive and representative of the semi-epic, semi-satirical compositions belonging to the thirteenth and fourteenth centuries. It had a direct bearing upon the social condition of the people, and its salient features are common to almost all languages. Adam de la Halle and Thibaut, Count of Champagne, were the principal song-writers. Rutebeuf was a clever but unwholesome writer of fabliaux, and Marie de France was justly esteemed for her lais and fables. Charles d'Orléans (1391-1465) is regarded as the last of the trouvères.

Chronicle-writing was abundant in the thirteenth and fourteenth centuries, though it only attained a high pitch in Froissart (d. 1410), referred to above, whose record of the hundred years' struggle between France and England has rarely been excelled for picturesqueness. Cuvelier acquired some reputation, though chiefly for his choice of subject, which was the romantic hero of Brittany, Bertrand du Guesclin. Monstrelet, who came some time later, was a trustworthy, though a not very artistic, chronicler. The *Roman de la Rose*, already alluded to, was a representative allegorical work, dealing with the joys and sorrows of lovers. It was during the fifteenth century that the transition from Old French into Modern French was accomplished. Philippe de Comines (1445-1509) combined the politician and the moralist with the historian. He was original and yet simple in style, and manifested an impartial judgment. Of lighter writers, mention must be made of Eustace Deschamps, who wrote patriotic ballads; Olivier Basselin, who called his bacchanalian compositions *Vaux-de-Vire*, from which came "vaudeville;" and François Villon (1431), a poet of irregular life, whose effusions have for generations received the hall-mark of critics. His *Grand Testament*, which is regarded as his masterpiece, is strong in humour and pathos. Out of the fabliaux developed the novelettes, the chief being the *Cent Nouvelles Nouvelles*; while a successful painter of contemporary manners was found in Antoine de la Sale (1398-1462), author of *Petit Jehan de Saintré* and *Les Quinze Joies du Mariage*. The first of sacred writers at this period was Jean Charlier de Gerson (1363-1429), Chancellor of the University of Paris, who wrote powerfully on behalf of religion and the Church. Another moral regenerator was the poet Alain Chartier (1386-1449) (q.v.). His principal title to fame is *Le Quadrilogue*

Invectif. Chartier was pure and noble in character, with a firm faith in the future of his country. The miracle play originated at this time, and the brotherhood of the *Confrères de la Passion* obtained official authorisation. Farces were performed by the law students, *Les Clercs de la Basoche* (q.v.), and soties by the *Enfants Sans Souci*. The latter, who attacked all persons and institutions falling under their displeasure, were suppressed by Francis I. The mysteries, after a chequered career, were prohibited by the Parliament of Paris in 1548.

The Reformation and the Renaissance of the sixteenth century had an important effect upon French literature. The first development was a religious revolution, directed against the abuses of the Papal system. John Calvin (1509-64) was the great leader of the reformers, and the earliest theological and literary result of the new movement was his *Institution de la Religion Chrétienne*. This luminous and vigorous work caused its author to be accepted as one of the fathers of French literature. Speaking generally, the Reformers were for a time "the leaders in philological science, in erudition, and in the industrial arts," though men like L'Hôpital and Estienne Pasquier are also worthy of mention. Coadjutors and contemporary reformers with Calvin demand some attention. Pierre Viret (1511-71), though born in Switzerland, laboured as a preacher in France with great success. His sermons were listened to by enthusiastic crowds in Paris, Lyons, and elsewhere. Théodore de Bèze (1519-1605) was a powerful supporter of Calvin. He was a learned polemic, and produced commentaries on the New Testament, a translation of the Bible, sermons, a metrical version of the Psalms, and a history of the Reformed Churches in France. Robert Estienne (1503-59), a member of a celebrated family of printers, produced eleven editions of the whole Bible, and twelve of the New Testament in Hebrew, Greek, Latin, and French, also a concordance of the Bible, and other works. His son, Henry, a distinguished grammarian and philologist, wrote an *Apologie pour Hérodote*, etc. François de la Noue (1549-91) wrote earnestly against impiety, injustice, and immorality; Duplessis-Mornay (1549-1623) published, among other treatises, the *Institution de l'Eucharistie*, which roused the whole clergy of France and Italy; Agrippa D'Aubigné (1550-1630), in addition to his *Histoire Universelle*, wrote *Les Magiques*, the *Confession de Sancy*, and other works which served the cause of truth by their remarkable wit, vigour, and imagination; and Clément Marot (d. 1544) exalted French verse by his effective translation of the Psalms, and his graceful epistles and elegies. On the Catholic side the men of letters were not so eminent as these, but among writers worthy of citation are Blaise de Montluc, Pierre Charron, Jacques Davy du Perron, St. François de Sales, and Pierre de Bérulle. But the most persistent opponents of the Calvinists were the priests of the Sorbonne, who were strongly ultramontane in their doctrines and methods. The philosophical revolution against the traditions of scholasticism was the second development of the Renaissance. It had several celebrated exponents. François Rabelais (1483-1553), in his allegorical

creations *Gargantua* and *Pantagruel*, attacked the lay powers with caustic dexterity, but absolutely scourged the monkish institutions with his biting wit and sarcasm. Bonaventure Despériers (d. 1544) wrote satirical fables with much of the spirit of Rabelais. Michael de Montaigne (1533-92), the illustrious author of the *Essais*, was one of the most original writers and independent thinkers of the age. An honest doubter, he was condemned for his scepticism by the Fathers of Port Royal. Estienne Dolet (1509-46), who published for Marot and Rabelais and other friends, and himself wrote Latin works in prose and verse, was executed for his free-thinking views; and Ramus (1515-72), a scientific and philosophic investigator, was slain in the general massacre of the Huguenots. The third development of the Renaissance was the literary revolt against the grammar and the art of the Middle Ages. Pierre Ronsard (1524-89), with his *Pléiade*, was at the head of this movement, and among other writers were Joachim du Bellay, Estienne Jodelle, Pierre de Larivey, Du Bartas, and Philippe Desportes. The only author who resisted the movement was Mathurin Régnier. The civil and religious dissensions of the age gave rise to a number of publicists, writers of memoirs, etc., including Bourdailles, Sieur de Brantôme, Jean Bodin, Francis Hotman, Nicholas Rapin, Pierre Pithou, etc. History was ably represented in De Thou; and Jacques Amyot, Bishop of Auxerre, produced a notable translation of Plutarch's *Lives*.

The seventeenth century saw the French monarchy consolidated and the national unity secured. Literature likewise attained a high degree of splendour, and masterpieces were produced in various fields of intellectual effort. An impetus was given to learning and the arts by Richelieu, who founded, in 1635, the Académie Française. He also founded the Imprimerie Royale, protected the Collège de France, and encouraged the study of the vernacular in the grammar-schools. The eminent court poet, Malherbe (1556-1621), re-introduced order and discipline in imaginative literature, though it must be admitted that much of the credit was due to his predecessors, Ronsard, Du Bellay, Desportes, and others. The ablest followers of Malherbe were the Marquis de Racan (1589-1670), author of *Les Bergeries*, a pastoral poem cast into a dramatic form, and the Président Maynard, author of *Poésies*. The spirit of sociality played a conspicuous part at this period in the regeneration of literature. The conclave of the Hôtel de Rambouillet rendered excellent service in the outset; but its influence was doomed to perish through its ultimate exclusiveness and bigotry, and it brought condign punishment on itself in Molière's *Femmes Savantes*. Among the frequenters of the Hôtel were Voiture, whose writings were permeated by the Italian influence, and Guez de Balzac, whose compositions were as strongly permeated by the Spanish influence. Associated with the meetings at Mdlle. de Scudéry's were Conrart, the poet; Chapelain, author of the *Pucelle*; and the writers of heroic romances, Gombauld and La Calprenède. Bohemian literary life had its representatives in Théophile de Viaud,

Saint-Amand, Saint-Pavin, Charles Sorrel, and, last but not least, Scarron, the author of *La Roman Comique*. The stage was vivified by the new life imported into the drama by De Vieux, Alexandre Hardy, Racan, Rotrou, and the "Five Authors," collaborators of Richelieu. Reform in moral and metaphysical philosophy was undertaken by Descartes, whose *Discours de la Méthode* indicated a new departure. The Port Royal des Champs signalled an attempt made by the Roman Catholics to reform their own Church, the moving spirits being the Arnauld family and the Abbé de Saint-Cyran. It was at the Hôtel de Rambouillet that Corneille (1606-1684) read his *Polyeucte*, and Bossuet (1672-1701) gave his first sermon. Among the other poets of the period may be cited the witty Claude de Malleville, Sarrasin, Godeau, and the court dramatist and entertainer, Isaac de Benserade.

The literature of the second half of the seventeenth century was even more brilliant than that of the first. No other age has witnessed such a galaxy of sacred orators as that which produced Bossuet, Bourdaloue, the golden-mouthed Massillon, Fléchier, and the benevolent and liberal-minded Fénelon, author of *Télémaque*. The drama also rose to its greatest height. Corneille produced his last tragedies, attaining almost the height of absolute perfection in his masterpieces *Le Cid*, *Cinna*, *Horace*, and *Polyeucte*. Space forbids us to mention his many other noble dramatic compositions. Corneille "created tragedy, inaugurated comedy, and prepared the opera." Molière (1622-73), confessedly the first comic poet among the moderns, exhibited his humorous creative genius in such masterpieces as *Le Tartuffe*, *Le Misanthrope*, and *Les Femmes Savantes*—works distinguished as much for their matter as for their sparkling style. Boileau (1636-1711), author of *L'Art Poétique*, *Le Lutrin*, *Satires*, *Épîtres*, etc., "personifies the taste and literary influence" of the time; Racine (1639-99), author of *Athalie*, *Phèdre*, and other tragedies, manifests the perfection of classical workmanship; while La Fontaine (1621-95), author of the *Contes* and the *Fables*, exhibited a nimble though not always praiseworthy wit in the former, and a graceful wisdom in the latter. In philosophy, in addition to Descartes, the founder of the modern idealist school, there arose Malebranche, an ingenious and elegant writer, whose chief work is *La Recherche de la Vérité*; and Blaise Pascal (1623-62), one of the profoundest thinkers of the age—a man of brilliant genius, whether regarded as a geometrician, philosopher, or man of letters. His *Lettres Provinciales* are perfect. There was a succession of novelists, including D'Urfé, Cyrano de Bergerac, and Furetière. Protestantism had its defenders in Claude, Saurin, Du Bosc, Bayle, and Leclerc; Jansenism in Claude Lancelot, Du Guet, Nicole, Le Maistre de Sacy, and Quesnel; and Free Thought in Saint-Evremond, Bayle, Chapelle, Chaulieu, and Madame Deshoulières. The political writers included Cardinal De Retz and Guy Patin. Conspicuous among the miscellaneous writers for genius and vigour were La Rochefoucauld, author of the *Maximes* and *Mémoires*; La Bruyère, the depicter of contemporary manners; Mézery, with his *History*

of France; Madame de la Mothe-Guyon, the sentimental mystic; the novelist, Madame de la Fayette, whose *Princesse de Clèves* marked a revolution in story-writing; and Madame de Sévigné, author of the famous *Lettres*. Transition writers between this epoch and the next included Le Sage, the author of the immortal *Gil Blas* and other works; Regnard, the writer of comedies; and the Duc de St.-Simon, author of those *Mémoires* which form the most striking condemnation of Louis XIV.

When the eighteenth century opened, France was the leader of social life and literature in Europe. In every branch of letters her writers exhibited far more than the average acumen, virility, and force; and, on the whole, there was a strong moral basis for every intellectual effort. But towards the close of the reign of Louis XIV. absolutism, immorality, and luxury began to bear their legitimate fruit. Criticism and innovation showed themselves in Montesquieu (1689-1755), whose *Lettres Persanes* and *Esprit des Lois* were conceived in a philosophical, satirical, and independent spirit; and also in Fontenelle (1657-1757), who sought to popularise science by his *Pluralité des Mondes*. The later Port Royalists included Rollin, author of the *Ancient History*; Louis Racine, the writer of sacred odes; and D'Aguesseau, who left behind him a graphic picture of the times. The transition poets embrace Jean Baptiste Rousseau, the best lyrical writer of his time; Crébillon, whose tragedies are somewhat turgid, and the dramatists Destouches, Piron, La Motte, and Gresset. The novelists included the Abbé Prévost, author of *Manon Lescaut*; the prolific Marivaux; and Bernardin de St.-Pierre, to whom we owe the charming prose idyll, *Paul and Virginia*.

The great intellectual luminary of the eighteenth century was Voltaire (q.v.) (1694-1778). He summed up within himself the various phases of the revolt against authority. He wrote classical dramas, epic poems, novels, satires, histories, and philosophical and scientific disquisitions. His *Zaïre*, *Henriade*, and *History of Charles XII.*, and the *Age of Louis XIV.*, represent the high watermark of his dramatic, poetic, and historical compositions. So extensive was his influence that during the last years of his life Voltaire became the arbiter of public opinion in Europe. Among Voltaire's critics were Fréron, author of the *Année Littéraire*; Gilbert, the fine lyrical and satirical writer; the poet Gresset, and Palissot, the writer of *Little Letters on Great Philosophers*.

The Encyclopædists were a body of philosophical writers who sought by means of the *Encyclopédie* to collect and classify all human knowledge. The work was suggested by a translation of Chambers's *Cyclopædia*. At the head of the French undertaking were Diderot (1713-84), and D'Alembert (1717-83). They were assisted by Marmontel, Condorcet, Turgot, Malesherbes, and others. The *Encyclopédie* became "the organ of the most advanced and revolutionary opinions of the time, was the object of the most violent persecution by the Conservative party in Church and State, and suffered egregious mutilations at the hands not only of hostile censors, but of timorous printers."

The work was, however, an epitome of the philosophic thought of the time. Buffon, the celebrated naturalist, wrote his treatises at this period; Condillac expanded the philosophy of Locke; and of the moralists, mention must be made of Vauvenargues, Duclos, and Thomas.

Following and completing Voltaire, and yet in certain aspects strongly antipathetic to him, was the celebrated Jean Jacques Rousseau (1712-1778). He sought to regenerate humanity, advancing his educational theories in *Émile*, his political ideas in the *Contrat Social*, and his views of natural morals—which were often opposed to the general conscience of humanity—in his *Nouvelle Héloïse*. There is no doubt that Rousseau's writings precipitated the Revolution. The lighter drama found its exponent in Beaumarchais, and the poetry of nature in Saint-Lambert, Lemierre, and Roucher. Literature was practically suspended by the Revolution of 1789, and oratory took its place. In the stirring pages of Carlyle and other historians we meet with the speeches of men of all parties, including Mirabeau, Mounier, Lameth, Sieyès, Barnave, Vergniaud, Guadet, Gensonné, Cazalès, Robespierre, St.-Just, etc. Revolutionary journalism had its Camille Desmoulins, Loustalot, and Marat; and Royalist journalism its Rivarol, Montlosier, and Mallet du Pan. Newspaper literature wielded immense influence, while extraordinary eloquence swayed the Assembly. Among general writers during the Revolution were Volney, Benjamin-Constant, Necker, and Madame Roland. Dramatic authors included Fabre d'Églantine, Chamfort, and Collin d'Herbeville. André Chénier, who lost his life on the scaffold, was the finest lyrical and descriptive poet; but the most stirring strains were sung by Rouget de l'Isle, composer of the *Marseillaise*, and Marie Joseph Chénier, who was essentially the poet of the Revolution. The Condillac philosophy was made the basis of all official teaching throughout the republic. A reaction set in against the tenets of the Revolutionists, St.-Martin and Joseph le Maistre writing from the religious side, and Mounier, Morellet, and Necker from the political point of view.

The Consulate and the Empire were not favourable to literature, and, notwithstanding the merits of Delille (1738-1813) and his school, it fell into decay. A new spirit, however, was infused by Chateaubriand (1768-1848), whose brilliant and glowing diction revealed new possibilities in the French language. Passages of his writings have never been excelled in grandeur, and he has been justly regarded as the father of the romantic school. Madame de Staël (1766-1817) opened up the treasures of foreign literature, and enthralled her readers by her romances. After the fall of Napoleon the revival of literature made further progress. Lamennais (1782-1854) was inspired to the discussion of profound religious problems; Lamartine (1790-1869), orator, poet, historian, was deeply Christian in his verse; and Casimir Delavigne, and Béranger (1780-1857), the Burns of France, sang jubilantly through their patriotism. Cuvier and Geoffroy Saint-Hilaire opened up the philosophy of the natural sciences, and Paul Louis

Courier the treasures of antiquity. During the reign of Louis Philippe a galaxy of great historians arose. Thiers wrote with patriotic ardour on the Revolution, the Consulate, and the Empire; Guizot, with a less plastic pen, discoursed of modern history; Mignet dealt with the Revolution from the metaphysical aspect; Thierry wrote with picturesque fidelity of past and present movements; Michelet infused the spirit of poetry into his writings; Louis Blanc impressed his historical productions with his own intense personality; and De Tocqueville wrote with philosophic breadth and insight upon the progress of democracy. Among other historians may be mentioned Droz, Henry Martin, and Duruy; while Sainte-Beuve raised criticism into a fine art, and was ably seconded in his treatment of literary history by Scherer and Villemain. These men were greater than the writers whom they immediately succeeded—to wit, Michaud, Daru, Lacretelle, and Sismondi. So in poetry La Harpe, Delille, Fontanes, Duval, Parseval-Grandmaison, Millevoie, Arnault, and Lemercier were to be followed by poets of nobler inspiration. Three ladies—Mesdames Coffin, De Souza, and Krüdener—had already done something to lift the standard of story-writing. The poet Jacquot Jansemin, or Jasmin, began a Provençal revival, and was followed by Romanille, the founder of a society for the preservation of the Provençal language and customs, Mistral, a poet of undoubted genius, and others. Poetic festivals were instituted to aid the movement.

By the middle of the nineteenth century literature had passed through its period of transition, and in some respects had undergone a complete change. Sociology was allied with philosophy in Fourier, St.-Simon, Auguste Comte, and Leroux. Littré and Taine combined the critical with the philosophic spirit in a remarkable degree. Idealism entered into the revival of religious thought, finding its Catholic exemplars in the Abbé de Lamennais, Baron d'Eckstein, Laurentie, Lacordaire, Ozanam, and Maurice de Guérin; while Protestantism had its exemplars in Vinet, Coquerel, and Monod. De Lamennais ultimately abandoned the Church and religion. An independent school of thought was founded for a time by Victor Cousin. The Deists embraced Jules Simon, Garnier, and Jouffroy, and the scientific freethinkers Renan and Havet. There were many great names among the Oriental, classical, and scientific writers—Champollion, Sylvestre de Sacy, Burnouf, Oppert, Barthélemy St.-Hilaire, Leclerc, Letronne, Charpentier, Arago, Bernard, Ampère, Milne-Edwards, Flourens, etc. Reviews and journals like the *Revue des Deux Mondes*, the *Siècle*, the *Journal des Débats*, and the *National*, acquired great influence. Literary criticism reached its culminating excellence with Nisard, Saint-Beuve, Girardin, Jules Janin, Prévost-Paradol, etc.

But the most interesting development in letters was the triumph of the romantic school in the domain of poetry and the drama. This mighty movement was led by Victor Hugo (1802-85) (q.v.), the universality of whose genius was astonishing. During his long career he threw off novels, plays, poems, and romances in dazzling succession. Next

to him in genius, though maintaining a somewhat independent attitude, was Alfred de Musset (1810-57) (q.v.), most beloved of all the French poets. Then came Baudelaire, Leconte de Lisle, Sully-Prudhomme, and François Coppée; while, still descending, we have the satirists Barthélemy, Brizeux, Barbier, and Alfred de Vigny, the two Deschamps, and the ultra-romanticists Gautier and De Nerval. Chief of comic dramatists was Scribe (1791-1864), who achieved an extraordinary success. There was some reaction from the drama of Hugo and Dumas the Elder, which was represented in tragedy by Soumet and Ponsard, and in comedy by Augier and Sandeau. Among the novelists Hugo was again first, but he had great contemporaries in the realistic school in Balzac, Mérimée, Flaubert, and Daudet. Naturalism has found its most striking exponents in Zola, Bourget, De Maupassant, and the brothers De Goncourt. The Dumas were prolific and picturesque, and George Sand, a woman of remarkable gifts, wrote passionately at first in her romances, and later with chastened fire and mellowed beauty.

In all its manifestations French literature has ever been the embodiment of the spirit of the time. An unworthy age makes an unworthy people, and susceptible men of genius reflect the national decadence in their pages; happily the converse likewise holds true, and with the growing stability of institutions in France, and the spread of enlightenment and liberty, the national literature can scarcely fall from the high intellectual level it has attained during the past half century.

French Polish, a composition with which furniture is rubbed to give it a smooth and glossy surface. It is obtained by dissolving gum-shellac in alcohol. A rubber of flannel or cotton-wool is saturated with the polish and rubbed persistently against the wood; the polish is thus forced into the pores of the latter. During the process the rubber is usually covered with calico dipped in linseed-oil. When the polish has hardened, it is rubbed with sand-paper before more is applied; but after the two last rubbings no sand-paper is used. Sometimes pumice and linseed-oil are rubbed over the surface after the polishing is complete.

Frequency of any periodic motion means the number of periods in unit time. Thus a seconds' pendulum which exhibits a uniform periodic oscillating motion, takes one second to pass from one side to another, or two seconds to complete the cycle of changes in position. It therefore effects half a period per second, and its frequency is said to be $\frac{1}{2}$. In the case of red light [COLOUR] the number of oscillations or periods of vibration per second is 4,024 billions, and the frequency rises in the case of violet light to 7,405 billions per second.

Frere, SIR HENRY BARTLE, BART. (1815-84), nephew of John Hookham Frere, entered the service of the East India Company in 1833. He did good administrative work among the Mahrattas as Resident and Commissioner at Sattara, and while Chief Commissioner of Scinde he checked the Mutiny by seizing Mooltan. As a member of the Viceroy's

Council he helped to re-establish the finances, and was highly successful as Governor of Bombay (1862-67). He was a member of the Council of India for ten years. In 1872 he first went to South Africa, where he negotiated a treaty with the Sultan of Zanzibar which abolished the slave-trade in the interior. Five years later he was made Governor of the Cape, and High Commissioner for the settlement of affairs in South Africa. The scheme of Confederation failed, and the Kaffir and Zulu Wars followed. Sir Bartle's conduct in the last was severely condemned by many statesmen, and when the Liberals came into power in 1880 he was recalled. He spent the rest of his life in literary pursuits, and died at Wimbledon. A monument to him on the Thames Embankment was unveiled in 1888.

Frere, JOHN HOOKHAM (1769-1841), an English man of letters and diplomatist, was born in London and educated at Eton and Cambridge. He entered Parliament in 1796 as a Tory, and to the *Anti-Jacobin* contributed *The Loves of the Triangles*, and a share of *The Needy Knife-Grinder*. In 1799 he succeeded his friend Canning as Under-Secretary for Foreign Affairs. In 1800 he became plenipotentiary at Lisbon, and was transferred to Madrid two years later. He was recalled in 1804, but in 1808 returned to his post. He persuaded Sir John Moore to attempt to hold Madrid, and the unfortunate result of his advice closed his diplomatic career. He now retired to Malta, married, and gave himself up to literature. He produced an excellent translation of Aristophanes, and a biographical work on Theocritus. His works were edited (with a memoir) by Sir Bartle Frere (q.v.).

Frère, PIERRE ÉDOUARD (1819-86), a French genre painter, was born at Paris, where he studied under Delaroche. He made his *début* at the Salon of 1843, and afterwards frequently exhibited in England. In his earlier days he painted artisan interiors, but he is chiefly known by his renderings of child-life. Mr. Ruskin warmly commended him.

Fresco. Fresco-painting is the art of painting on walls covered with plaster in such a manner that the colour and plaster unite and form a single substance. The colours are mixed with lime before being applied, and lime is also the chief ingredient in plaster, so that only those colours can be used which are able to resist its decomposing influence. These are for the most part natural earths. The use of the term "fresco" properly implies that the painting is executed on a freshly-laid surface which is still damp; but the art of painting on dry plaster was also known to the Italians under the name *fresco secco*, so that we must distinguish between this and the "true" fresco (*buon fresco*). Fresco-painting was practised in Egypt at a very early date, and the Etruscans made use of it in decorating their tombs, which were cut out of tufa. Great progress in the art was made by the Romans, as is shown by paintings on walls in Pompeii, but it afterwards fell into disuse, and was not revived till the 12th or 13th century. The early mediæval fresco was *fresco secco*, for the art of painting in true fresco was not discovered till the latter part of

the 14th century. In *fresco secco* the surface was sprinkled with water immediately before painting, and the colours and the wall were allowed to dry together. It is now customary to rub the *intonaco* or final coatings of plaster with pumice-stone as soon as it is dry, and afterwards to moisten it with water mixed with a little lime. The moistening takes place the evening before painting, and is repeated just before the artist sets to work. In *buon fresco* fresh plaster is laid on each time that the artist begins painting, and he is careful to remove any that remains when his day's work is over. Thus in this case the plaster never dries till the painting has become incorporated with it. The first step taken by the artist is to transfer the outline of his design from a cartoon which he has previously prepared to the damp surface of the wall, either by "pouncing"—i.e. allowing some of the powder called "pounce" to pass from a muslin bag through holes pricked in the outline on to the plaster—or by actually piercing the design with the blunt point of a stylus. There was considerable variety in the methods of carrying out this operation employed by different artists. When the outline had become implanted on the wall, the artist completed his design in accordance with a small coloured sketch, which he carried in his hand. Fresco-painting necessarily requires great speed, as the drying of the *intonaco* involves fatal results. For this reason the Italian masters were often prevented from finishing their frescoes to their own satisfaction, and added further detail in distemper. Yet there are not wanting paintings—those of Masaccio, for example—which are completed in true fresco, without any admixture of distemper.

Freshwater Herring, a Scottish name for (*Coregonus clupeoides*). [COREGONUS.]

Fresnel, AUGUSTIN JEAN (1788–1827), a celebrated French optician, born at Broglie, department of the Eure. He was the first to construct compound lenses as substitutes for mirrors, and helped to establish the undulatory theory of light by his discoveries and deductions. He was a friend of Arago, and a fellow of the Royal Society; and his works were published by the French Government long after his death.

Freycinet, CHARLES LOUIS DE SAULCES DE (b. 1828), a French statesman, was following the profession of an engineer when in 1870 Gambetta appointed him to the War Department, where he did much to reorganise the army. In 1876 he was elected senator and was Minister of Public Works under Dufaure and Waddington (1877–79). He was then Foreign Minister and Premier for a few months, and again held that office from January to July, 1882. In April, 1885, he became Foreign Minister in the Brisson Cabinet, and was Premier for a third time

when it broke up. He was War Minister under Floquet (April, 1888), under Tirard (February, 1889), and under Dupuy (November, 1898). He is a member of the Académie des Sciences.

Freyja, the Scandinavian Venus, was particularly worshipped in Sweden. She was supposed to ride in a chariot drawn by two cats, and to claim half of those slain in battle. The word *frau* (woman) is supposed to be cognate with this name.

Freyr, a Scandinavian god presiding over the weather. His wooing of Gerda, daughter of the giant Geymer, is a leading episode in northern mythology. His chief temple was at Upsala, and his festival was kept at Christmas.

Freytag, GUSTAV (1816–1895), German novelist and dramatist, was born at Kreuzburg, Silesia. From 1839 till 1847 he was a professor of German at Breslau, and was for many years a journalist at Leipzig. He is the greatest of German novelists, his chief works of this kind being *Soll und Haben* (*Debit and Credit*), a picture of mercantile life; *The Lost Manuscript*, and the series called *Die Ahnen* (*Our Ancestors*). Among his plays, *Die Journalisten*, is the best known. Freytag was a deputy to the North German Diet, served in the Franco-Prussian War, and in 1886 was made a *Geheimrath* (Privy Councillor) of Coburg-Gotha.

Friar (Lat. *frater*, Ital. *frate*, French *frère*) means "brother," and has been generally used of members of religious brotherhoods. Strictly speaking, friars were members of an order under the rank of priest, the latter being called "father." They are distinguished from monks, who belonged to older foundations, and did not travel about and preach among the people as the friars did. The 13th century saw the rise of the Grey Friars or Franciscans, the Black Friars or Dominicans, and the White Friars or Carmelites, as well as of the Augustinians or Austin Friars. Later also there were the Crutched (Ital. *crociati*) Friars, or Trinitarians. In England the friars were not only founders of schools of theology, but also the leaders of the people in political matters during the Barons' War. Their political songs are the first rough expression of democratic theory in English literature. In the 14th century, however, they became rich, and soon lost their influence. Their principle of mendicancy and interference with the parish priest were attacked by the monks and regular clergy; and Wyclif, while agreeing with them in these matters, was opposed to the orthodoxy of their doctrine. They in return became the enemies of the Lollards. The degeneracy into which the friars had fallen appears from the description given of them in the *Vision of Piers Plowman* (end of 14th century) and in the *Canterbury Tales* (Prologue). Dr. Jessopp's *Coming of the Friars* gives an interesting account of them.

